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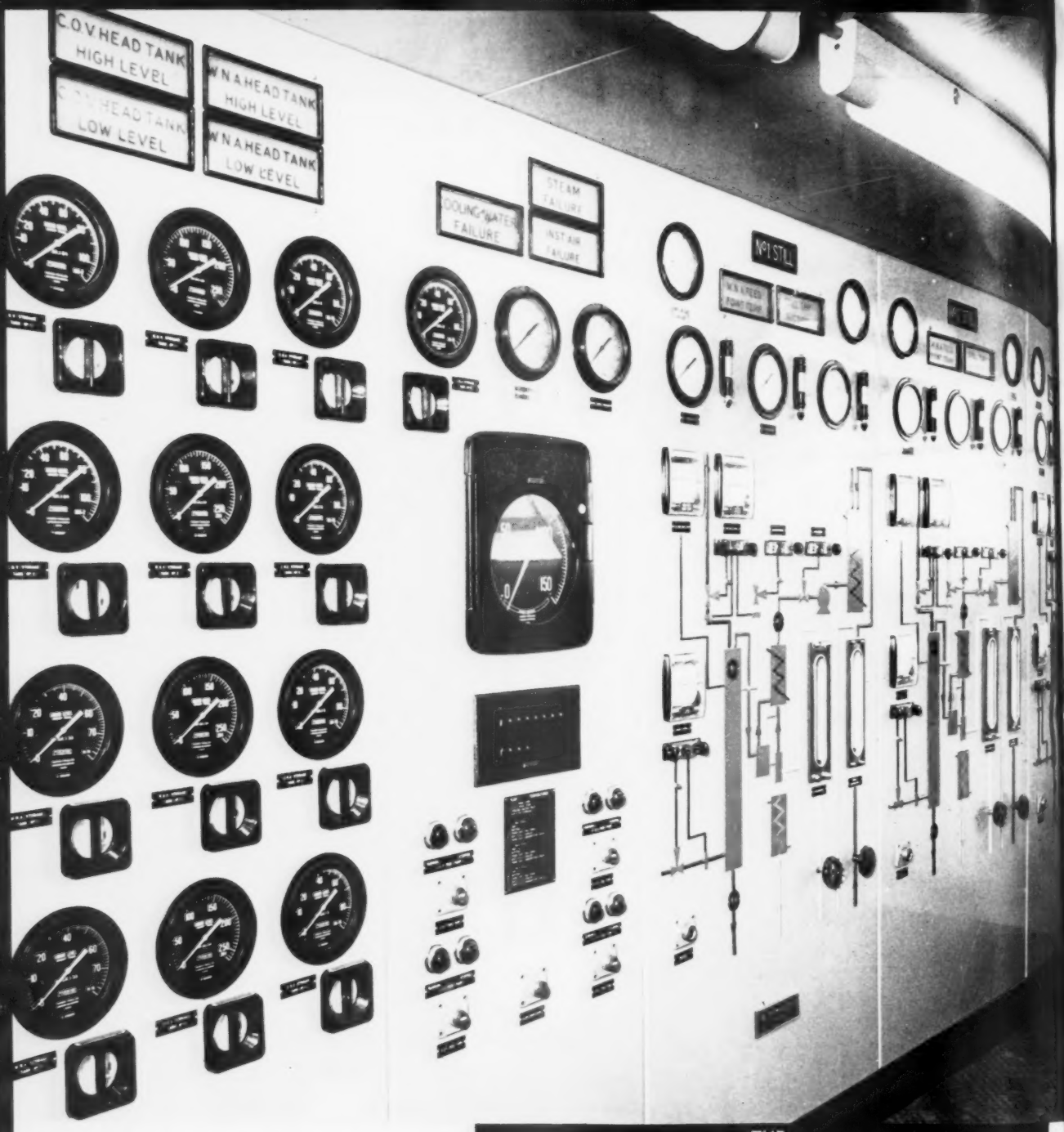

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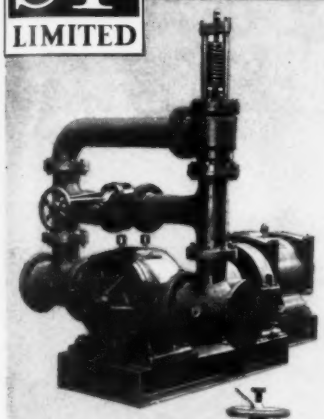
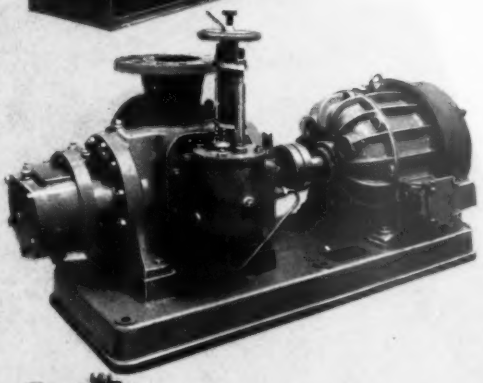


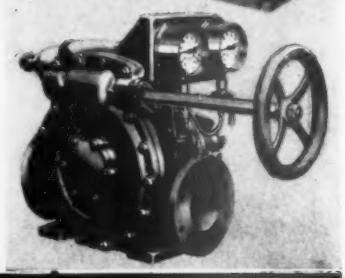
(Left)
Positive Acting Rotary Displacement Pump for the handling of Molasses and viscous fluids, electrically driven through totally enclosed Reduction Gear Box.

(Below)
Suitable for handling Spirits and other volatile fluids, this Screw Displacement Pump is of the all round clearance design and is capable of working with a high suction lift. The flow is practically pulseless and the unit self priming.



(Above)
Positive Acting Variable Output Rotary Piston Pump. Electrically driven through Reduction Gear Box, for Oils of varying viscosity.

(Right)
Reversing Flow Rotary Displacement Pump for fitting on tank wagons. These pumps are driven from a power take-off on the gear box.



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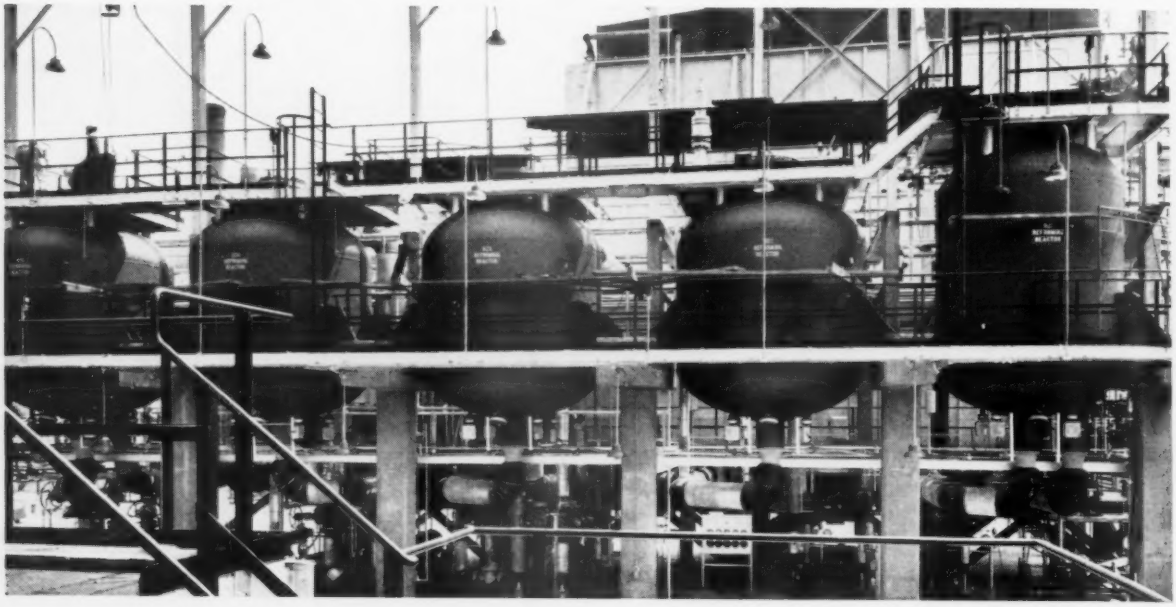

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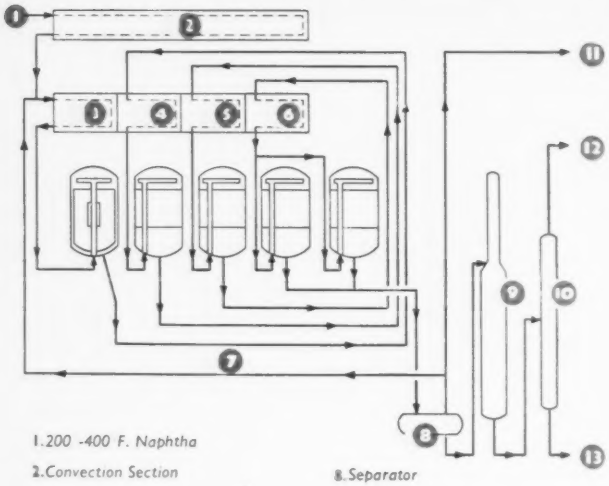

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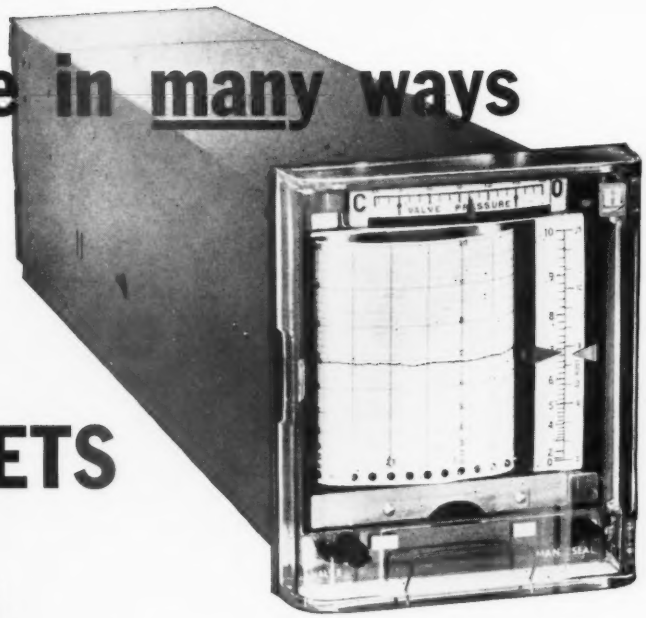

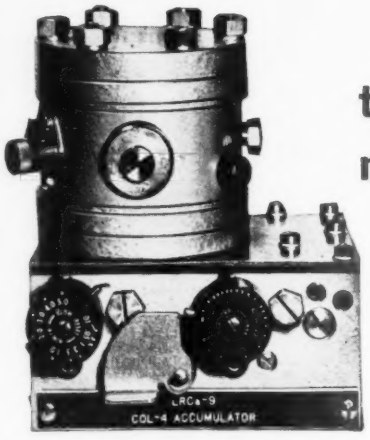

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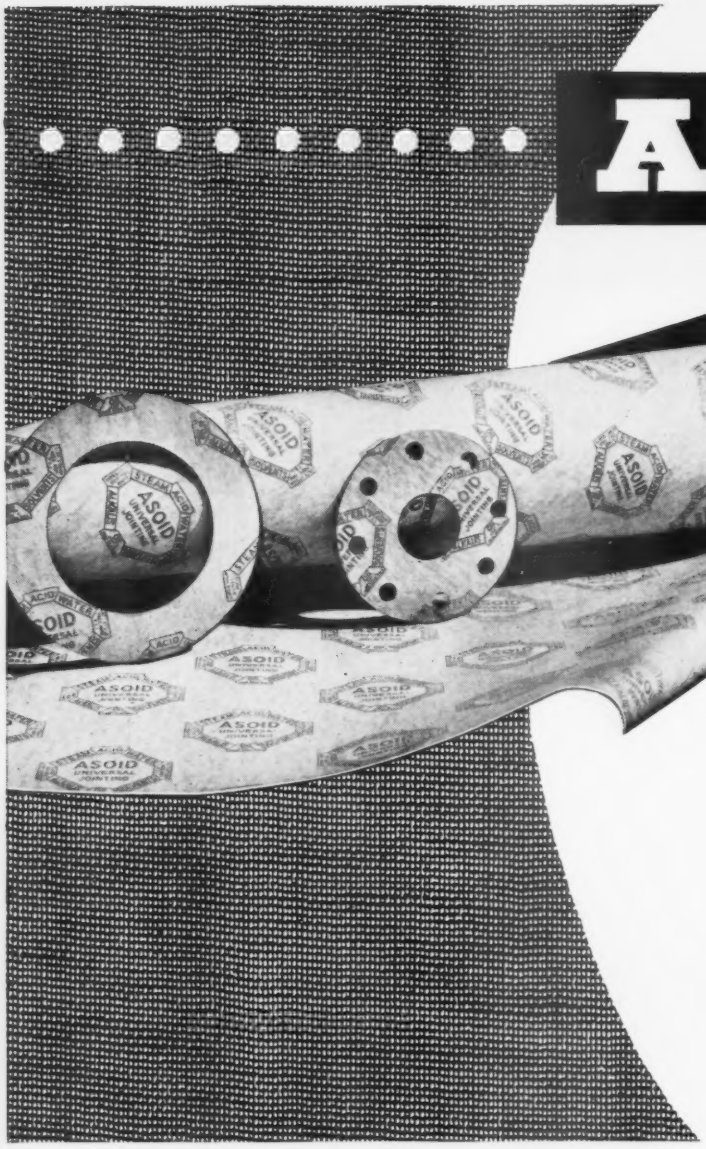

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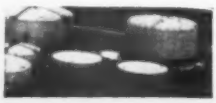

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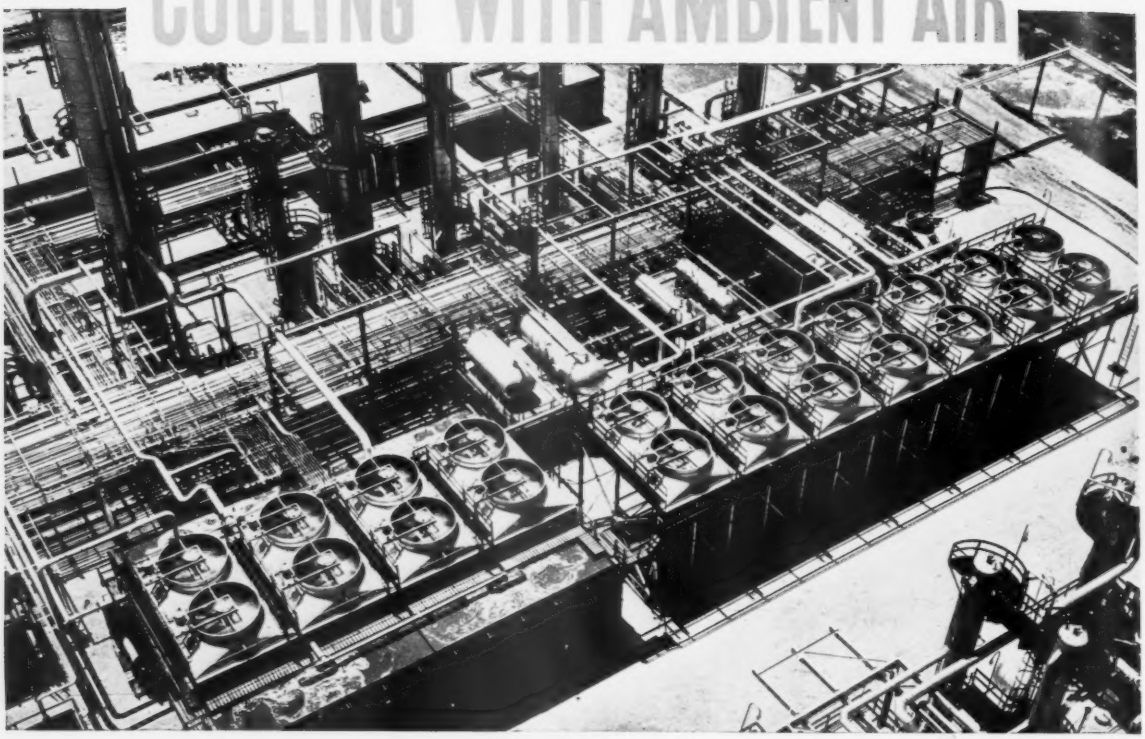

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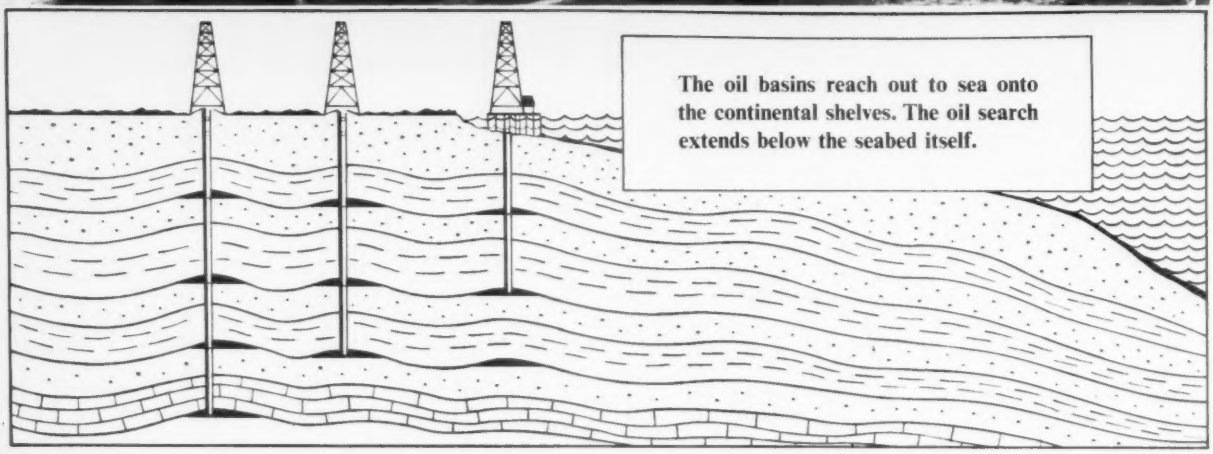

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The first oil drilling in shallow water was off the Californian coast in the 1880s. In the 1920s and 1930s came the vast oilfields in the Lake of Maracaibo in Venezuela. Wells offshore in deeper water were drilled off the Gulf Coast after 1945, and many oil and gas fields have since been found there.

Today some three hundred sea wells are drilled every year. Some are as much as 40 miles out from the land, and in 100 feet of water. Drilling is in progress in the Persian Gulf, off Borneo, the Argentine, California and elsewhere. In other parts of the world, exploration of the continental shelf has only started. There are ever increasing demands for oil. The continental shelves will add to the bigger reserves needed to meet them.

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*Forecasting Demand in Industries Associated with Road Transport**

By E. H. J. DIXON†

The livelihood of a large section of the population is now derived from road transport and its associated activities. Half a million people are employed in the manufacture of motor vehicles, parts, and fuels; another quarter of a million in distribution, repair, and filling stations; and a million and a quarter in vehicle operation—mainly drivers and crews of goods and public transport vehicles. This adds up to 2 million, and with another 100,000 employed on road construction and maintenance, makes nearly 10 per cent of the employed population. The proportion has risen from 8 per cent five years ago.

National expenditure on road transport and travel is running at over £2200 million per annum, about 11 per cent of total domestic expenditure. Here again the proportion has risen steadily over the past few years. Expenditure on goods transport is nearly half the total.

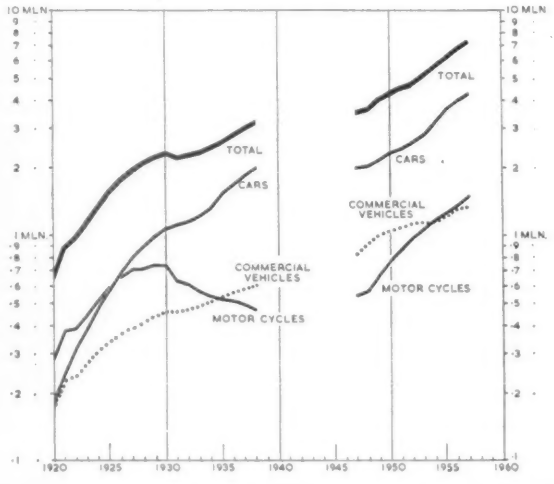
Investment in road vehicles, including the estimated expenditure on cars bought by businesses, was £285 million in 1956, about 9 per cent of total gross fixed capital formation. In addition about another £130 million or 4 per cent of total investment was spent on the roads, of which, however, more than four-fifths went on maintenance, repair, and minor improvements, and less than one-fifth on major improvements.

The main factor in the growth of road transport is, of course, the number of vehicles in use. Fig 1 shows the picture from 1920 to 1957. In order to compare rates of growth the numbers are plotted on a logarithmic scale.

The total number of vehicles increased consistently during the 1920's, suffered a slight setback in the early 1930's, and from then on continued to rise, but at a slower rate than in the previous decade. During the second world war the number dropped, but by 1946 was back to nearly the same total as in 1939. Since 1946 the vehicle population has been increasing at the same or slightly faster rate than in the immediate prewar period.

The history of the car population, shown in the second line, is similar, although here the recovery from the war came several years later.

Fig 1



The third line for motor cycles shows a different pattern. In the early 1920's these were more numerous than cars and their number was increasing, though less rapidly than cars. After 1929 the number began to fall, due partly to the introduction of compulsory third party insurance, but also to the progressive cheapening of car motoring. Many previously only able to afford a motor cycle could now afford a car. Since a considerable proportion of the motor cycles in use represents a hidden demand for cars, for some purposes of prediction it is better to consider their combined numbers rather than those for cars alone. Excluding motorized pedal cycles, the

*Read before the IP Economics and Operations Group on 9 October 1958.

†Esso Petroleum Co. Ltd.

number of motor cycles has been growing recently at about the same rate as the number of cars.

The fourth line shows the trend of commercial vehicles, including taxis, as well as public service vehicles and goods vehicles. Taxis halved in number during the decade before the war, recovered after the war to their peak of the late 1920's, but by 1956 they had fallen away again very sharply. This appears to be another example of a substitute vehicle. The number of buses and coaches rose steadily until the war and continued rising afterwards until it levelled out during the early 1950's.

The main component of the commercial vehicles line is, however, goods vehicles, which accounted for over 90 per cent of the total in 1956. Here the growth appears to have been fairly steady over the whole period since the mid-1920's, with the exception of the flattening during the depression of 1930 and 1931, and a spurt after the second world war.

In predicting future vehicle populations the extrapolation method will give different answers according to which particular historical period is selected as the basis for projection and what type of curve is fitted. For cars, it is perhaps safe to say this much: that the annual census data during the immediate pre-war and the post-war periods lie close to the line of a 6 per cent to 7 per cent compound annual growth, which represents a doubling in 10–12 years.

As for the correlation method, this has been used for forecasting the number of cars in use by such means as establishing a relationship with real income per head or with the number of incomes over a certain limit. In these methods there are difficulties in addition to the problems of forecasting the future trend of national income and the distribution of incomes. In particular, it is hazardous to deduce a relationship between income distribution and car ownership owing to the extent of business assistance. No official data is available on this, and the national income statisticians admit that their estimates are arbitrary assumptions, with a variation of plus or minus more than 10 per cent, but with no indication of how much more than 10 per cent.

However, market research sample surveys suggest that at present about 40 per cent of cars are used for pleasure purposes only, the remainder being used for business and pleasure. So it is a fair assumption that getting on for 60 per cent of motorists are to a greater or lesser extent business-assisted. To put the figures in another way, out of every 100 homes in the country about 25 apparently now have a car. But of these 25 perhaps only 10 are covering the whole cost of owning and running the car.

Unfortunately very little information is available about the actual monetary value of business assistance either in total or by classes of motorists. What some of the sample surveys have revealed is that while the proportion of households owning cars increases with income, so also does the proportion receiving business assistance. Apparently the propensity to own and run a car out of one's own pocket rises but slowly with income; while the propensity to receive business assistance to do so rises fast.

It is not only ignorance of the precise extent and application of business assistance which complicates forecasting, but also the fact that its incidence has changed much during recent years. Although "pleasure-only" motorists are still only 40 per cent of the total, it is probable that since 1951 the numbers in this class have more than trebled while the number of business-assisted cars has risen by only a quarter. Furthermore, a large number of "unassisted" cars is owned by homes where the chief earner is in the lower income groups—say under £750 a year. There are two reasons for this. First, the importance of contributions to the household income from secondary earners. It was estimated that in 1955 when the number of individual incomes of over £1000 a year after tax was just over 1 million, there were $1\frac{3}{4}$ million households with spendable incomes over the £1000 mark, derived from the earnings of three or more earners per household. Secondly, the minimum cost of motoring is very much lower than any estimated average, and the actual cost depends largely on the amount the car is used. In fact, motoring of a sort is possible at any cost above that of the annual tax and compulsory insurance.

Though the prospect of a further doubling of the car population in 10–12 years may seem to some a horrifying prospect, the number in use actually doubled in the eight years from 1949–1957 and in the nine years from 1929–1938. In fact, the history of car population forecasting is one of consistent under-estimation. In the 1930's prophets predicted a saturation point of 2 million; this was passed by 1939. In 1950 the Director of the Road Research Laboratory estimated that we might have $3\frac{1}{2}$ million cars on the road by 1960; this number was exceeded in 1955.

Turning now to the future trend of commercial vehicles in use, we have different problems. The growth of private motoring has already had serious repercussions on public transport, both rail and road, and it seems likely that the number of buses and coaches in use, which has been stable for some years, will soon begin to decline.

In goods vehicles the growth continues unabated. It is useful to look at this expansion against the background of the total volume of freight transport whether carried by road, rail, coastal shipping, or inland waterways.

Estimates for the three years 1938, 1952, and 1956 of British domestic freight transport expressed in terms of ton-mileage carried are shown in Fig 2. The 1952 estimates were given in a paper read to the Royal Statistical Society in 1954 by Messrs K. F. Glover and D. N. Miller: the figures for the other two years are my own estimates and are to be regarded as indications of the orders of magnitude rather than precise calculations.

The general picture is however clear enough not to depend on the degree of precision of the statistics. The index numbers at the foot of the chart show that over the whole period the total of ton-miles for all forms of transport combined rose to about the same extent as industrial production, both having increased by approximately 50 per cent since 1938. But since 1952 the volume of transport has increased much more slowly than production.

With the continued expansion throughout the period in the proportion of goods carried by road, the volume of road freight increased more than twice as fast as industrial production from 1938 to 1952, and at about the same pace from 1952 to 1956. The annual ton-mileage of road transport now exceeds that of the railways, having first passed the rail volume about two or three years ago. Rail freight ton-mileage reached a peak during 1951–53 and has since been declining slowly, whereas since then road freight has risen by about 20 per cent. The shares of total freight traffic in 1956 can be estimated as: road 43 per cent, rail 39 per cent, coastal shipping 18 per cent, with inland waterways at less than half of 1 per cent.

The change in the relationship between industrial production and ton-miles of freight reflects, in part, changes in the structure of industry. At first, mineral products such as coal and ores predominated in industrial output, but in later

stages new products with a higher value in relation to their weight have increased in importance while there have been progressive economies in the use of raw materials and fuel. As a result, the physical weight of industrial input and output tends to rise more slowly than the index of production—and so does the volume of transport measured in ton-miles.

The changing pattern of industry is also behind the faster growth of road than rail traffic. Traditionally the railways have been bulk carriers of commodities with a low value in relation to their weight, particularly coal; and movements of coal and other solid fuels still provide about half the rail freight, as they did in 1938. But since then coal production has become an appreciably smaller proportion of industrial output, the tonnage mined having declined slightly while the total industrial production has risen by one-half. So the proportion of freight going by road rises not only, or even mainly, from rail-users turning to the roads, but also from new users choosing road transport for the newer industries.

It is in fact in the field of fuel transport that some of the most important changes have occurred. Since 1938 the use of oil in this country has trebled and its share in total primary fuel consumption risen from 7 per cent to 15 per cent, but little of this increase has been reflected in the volume of rail transport; and this trend will almost certainly continue.

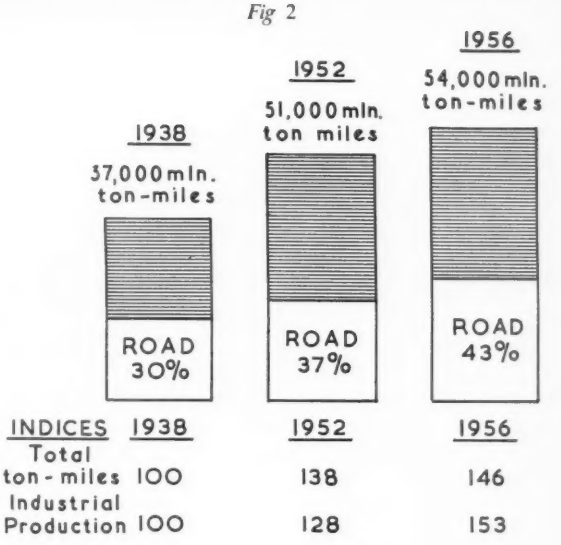
An important feature of modern Government policy is decentralization of industry, by setting up industries—other than heavy industries—at a distance both from the sources of raw materials and from the centres of consumption in order to utilize local labour and to avoid further concentration in already crowded localities. Often the interests of both industry and Government coincide in this policy. Since the costs of road transport are roughly of the same order of magnitude whether the traffic volume is large or small, a policy of serving dispersed industries by road transport is much less costly than the traditional one of keeping in operation secondary railway lines with heavy deficits. Here is another factor in the relative growth of road goods traffic.

This example shows that one cannot talk for long about transport without getting into a discussion on Government policy. As stated by the Economic Commission for Europe in their 1956 Survey of Europe, "the future volume of transport can be forecast only on the basis of explicit assumptions about those economic policies which directly or indirectly influence its growth". Apart from general economic policy on the pace of expansion, and departmental policies on location of industry and fuel and power, the future growth of the road goods transport fleet will be affected by policies on vehicle licensing, road construction and improvement, road transport nationalization, rail charges, and railway investment—to mention only the more obvious factors.

With regard to the British Transport Commission's plan for modernizing the railways, the Commission pointed out that while the BTC's plan assumes an *increase* in rail freight traffic, the 1954 rail volume compared with that of 1913 was actually 23 per cent *down* in terms of tons loaded and in terms of ton-miles only 21 per cent higher. Over that 40 years industrial production rose by 140 per cent.

To sum up on commercial vehicles, there are no convincing reasons to suggest any marked slowing-down from the present rate of increase in the number of vehicles in use. If one discounts the post-war bulge, the data for the 1930's and 1950's fall near to a line representing a 3½–4 per cent annual compound increase, equivalent to a doubling in 18–20 years. The rate of increase for goods vehicles alone would be slightly higher than this, but the calculation would imply a further decline in the number of hackneys, that is taxis and public service vehicles.

Fig 2



INDICES	1938	1952	1956
Total ton-miles	100	138	146
Industrial Production	100	128	153

Bearing in mind of course the perils of extrapolation, it would be interesting to consider the size to which the total vehicle population *could* grow over the next decade or so. In 1956 there were licensed about 5 million cars and motor cycles, excluding motorized pedal cycles and 1·3 million commercial vehicles. By 1966 there could be 9–10 million cars and motor cycles and nearly 2 million commercial vehicles: that is in total some 11–12 million vehicles against 6·3 million in 1956. This would represent a rate of increase for all vehicles of nearly 6 per cent a year.

These are the sort of figures that are now under serious consideration. The main question is probably whether the road system of the country could be adequate by this time ahead to carry such a volume of traffic. So far the road planners are assuming, to quote the road research authorities, "that the task is to examine the tailoring of the highway system to the traffic and not the tailoring of the traffic to the highway system". They go on: "Tailoring of the traffic raises another wide variety of possibilities, ranging from restrictions on the numbers of motor-vehicles available to the public, to the banning of motor traffic in certain areas or to certain classes of user. The need to examine this approach in detail exists now and will become increasingly urgent".

The technical problems in providing the necessary road capacity for such an expansion in the vehicle population can probably be solved. What is not yet clear is whether the present and future Governments will accept the costs, both economic and social, of undertaking the task. Before leaving this aspect, two statistics should be mentioned which are worthy of note.

First, a comparison with the U.S.A. Between 1950 and 1955 there was a considerable amount of road building in the States and in that period vehicle mileage in that country increased by 27 per cent. In Britain on the other hand, investment in new roads and major improvements was negligible during the period and yet vehicle mileage rose by 44 per cent. Thus traffic increases despite the absence of road building.

Secondly, in Britain the busiest 1 per cent of the whole road carries 25 per cent of the traffic and the busiest 10 per cent carries 60 per cent of the traffic. So a large proportion of the traffic on the roads would be affected by improving a small proportion of the road system.

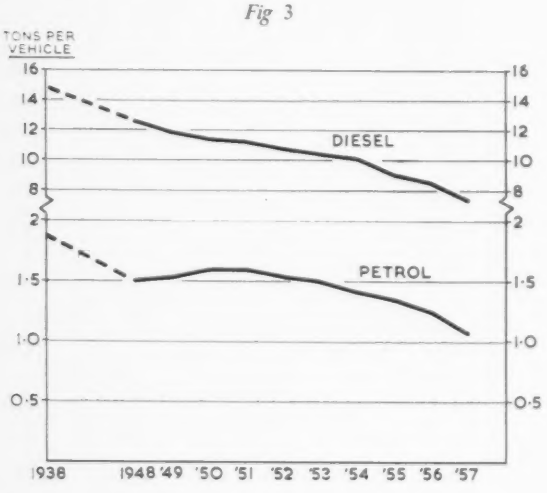
To turn now to the demands which derive from the vehicle population. These include the demands for new vehicles for replacement and expansion, and the demands for replacement parts and fuels needed to keep the fleet in operation.

Amongst the complex of factors which govern the demand for these products, a major one is the number of vehicles in use which has been the subject of the paper so far. But in the complex, another important variable is the amount of use made of each vehicle, and it is this which will now be considered. Clearly, at any one time, the number of vehicles required to meet a given demand for motor transport depends on the intensity of vehicle usage; while changes over time in the intensity of usage affect the replacement demand for vehicles and parts. The life of a vehicle, considered as a piece of machinery, is to be measured rather by miles run than by years elapsed, and apart from technical changes, a reduction in average annual mileage is reflected in a rise in years of life. This naturally also applies to components whose life is much shorter than that of the complete vehicle, such as tyres.

But to make the generalization that if a vehicle is used less it will last longer—and conversely—is not to say that given figures for annual average mileage, and the average useful life in miles, of items such as engines, transmission systems, and so on, one can predict average vehicle life. Manufacturers now supply replacements for nearly all components, both major and minor—at least for their current and recent models—and the life of a vehicle can, technically, be greatly prolonged. What really determines when a vehicle will be scrapped are in the last resort economic considerations; and the mileage at which a vehicle is scrapped may differ widely in different economic conditions.

However, awareness of the broad trends of average vehicle usage is of considerable value to the forecaster, particularly when he is looking a few years ahead. Statistics on this are few and the picture of vehicle mileage, and particularly of its development over time, has to be pieced together from such limited information as is available.

Fig 3



A convenient starting point is the consideration of the rate of wastage in the vehicle population.

A statistical indication of wastage is given by the excess of new registrations over the increase in the number of vehicles in use. On this basis, during the 5-year period 1933–1938, over half the car population apparently went out of use and was replaced. In contrast, after the war scrappage of cars has been very low and over the latest 5-year period, 1952–1957, was still only a quarter of the pre-war rate, rising but little even by 1957. For commercial vehicles, while the pattern is the same, the reduction from the pre-war scrappage rate has been less marked and in the latest 5-year period it was about two-thirds of the pre-war figure.

Part of the explanation is the limitations on motoring which remained in force after the war. Petrol was rationed until 1950 and the supply of cars to the home market was restricted until 1953–54. But the fact that by 1957 car scrappage was still so low compared with pre-war experience suggests that other changes have been at work; and the reduction in the scrappage rate for commercial vehicles cannot be attributed to any appreciable extent to the post-war restrictions. There is a presumption, then, that average vehicle life has lengthened, possibly reflecting a fall in annual mileage per vehicle.

As for direct statistics on vehicle mileage, public road passenger transport and vehicle operation by the Transport Commission is fairly well covered; and for total goods transport we have a 1952 bench-mark provided by a Ministry of Transport sample enquiry. For the rest, we have to infer the figures from the statistics of traffic flows compiled from traffic counts carried out all over the country.

On this basis, and after allowance for the changing composition of the total vehicle fleet, the index of average annual mileage per vehicle rose from 100 to 121 during 1922–1938, and fell to 110 in 1951–1952 and 105 in 1956. Owing to the necessarily rough and ready nature of the calculations, it is inadvisable to read too much into the actual numbers, but the picture is broadly correct.

Estimates of actual annual miles run by each main type of vehicle show that the reduction between 1938 and 1952 was proportionately heaviest in the combined figure for cars and taxis—down from 9900 to 8400; and in goods vehicles—from 13,800 to 11,400. Since then there has been a tendency to fall further in all classes, although goods vehicles miles rose between 1952 and 1955, presumably since there was a recession in 1952 and a boom in 1955. Mileage in 1956 and 1957 was affected by oil rationing in the Suez crisis, which accounts for part but perhaps not all of the fall since 1955.

In the case of cars there are a number of possible explanations of a trend to lower average mileage: the post-war increase in taxation of motor gasoline; the recent expansion in the number of motorists using cars for pleasure over low annual mileages: and the deterrent effect of overcrowded roads. Also taxis are included with cars in those figures, and the number of these has fallen sharply in the last few years.

Finally, a word on post-war trends in annual consumption per vehicle of motor fuels and motor tyres. Fig 3 gives the picture for motor fuels. In diesel fuel, annual consumption per vehicle has approximately halved in 20 years, falling from nearly 15 tons in 1933 to about 7½ tons in 1957. For petrol, the exact numbers are less certain. Here the figures are based on total deliveries of motor spirit, of which about seven-eighths is used for road vehicles; and on total petrol-engined vehicles in use, excluding motor cycles. But after

allowing for these qualifications the trend is still a real one. On these figures, consumption per vehicle fell from about 1·9 tons in 1938 to 1·5 tons in 1948. It recovered to 1·6 tons after the removal of rationing, but has since fallen again to 1·25 tons in 1956. The last point for 1957 was obviously affected by rationing at the time of Suez.

There are probably many reasons for these trends. Certainly improved efficiencies of engines and fuels are a major influence. But reduced annual mileages must also be a contributory factor. A somewhat similar picture is shown by the figures of sales of motor tyres for replacement. Here again there is a combination of causes, including improved tyre performance, but the figures to some extent reflect lower mileages.

To sum up, two aspects of forecasting demand in the road transport industries have been examined. First, the tendencies at work in the growth of the number of vehicles in use, and the size of the vehicle population which we should be faced with in a few years time, if current trends continued; and secondly, the changes in average vehicle mileage indicated by recent experience, although not yet entirely proved. The trends of these two factors in demand may, of course, be inter-dependent. The additions to the vehicle fleet may increasingly be low-mileage vehicles, which progressively lower the average mileage per vehicle. In fact a further large growth in the fleet may, in the foreseeable road conditions in this country, only be possible if vehicles are, on the average, used less.

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G. H. COXON

G. H. Coxon

G. H. Coxon, F.Inst.Pet., retired from the honorary treasurership of the Institute after the recent Annual General Meeting, having served in that capacity since 1947. Mr Coxon's association with the Institute started in 1918 when he first became a member and since then he has served in various capacities. He was first elected to Council in 1930 and was a vice-president during the period 1942–1948. In the 1946–47 session he was chairman of Council during the presidency of Sir Andrew Agnew and in 1954 was awarded the Eastlake Medal for his services to the Institute.

Speaking at the Annual General Meeting the President, C. M. Vignoles, said that Mr Coxon as honorary treasurer had made a major contribution to the success of the Institute over the past 12 years. He had guided its financial fortunes in such a way that the splendid premises which the Institute now occupied were themselves a tribute to the skill with which those finances had been handled over the past years. In thanking Mr Coxon on behalf of the Institute for his services Mr Vignoles said it was impossible to say how greatly he would be missed by everyone.

Mr Coxon's first contact with the oil industry was in 1914, when he was appointed by the Cowdray Group as manager of the Tampico refinery of Mexican Eagle Oil Co., having previously been superintendent and general manager for S. Pearson & Son of Vera Cruz Electric Light and Power Co. In 1919 he became manager of the Company's Southern Division, and of the Minatitlan refinery. Returning to London in 1924 for health reasons, he joined Anglo-Persian Oil Co. in the following year as general manager, Refineries Department, with particular responsibility for product improvement and diversification, and overseas expansion. In 1945 he was appointed manager of Central Planning Activities, co-ordinating the Group's expansion policy disorganized by wartime action. In 1954 he retired from active service with Anglo-Iranian owing to severe illness.

Mr Coxon has expressed his regrets at being unable to attend the Annual General Meeting, for he very much wanted to be there to say "*au revoir*" at the end of a long association with the building and with the expansion of the Institute.

NEW MEMBER OF COUNCIL

R. H. W. Hamilton

R. H. W. Hamilton, M.A. (Cantab.), to fill a casual vacancy on the Council of the Institute. Mr Hamilton joined Shell straight from Cambridge in 1928 and went to Sarawak Oilfields Limited as an administrative assistant. After five years' training in the Miri and Seria oilfields he went to the B.P.M. in The Hague and then to the Astra Romana in Rumania.

In 1934 he went to the U.S.A. and worked with Shell in California and the Middle West, specializing in oil property management and lease evaluation. Subsequently he moved to the Shell head office in London and transferred in 1938 to the Iraq Petroleum Company head office, where he remained until world war II.

During the war he held a temporary commission in the R.N.V.R., in which he became a Lieutenant Commander, initially working on ship protection against magnetic mines and subsequently in battleships on the Arctic convoy route.

After the war he returned to the Iraq Petroleum Company head office in London and then transferred to the exploration headquarters, which was set up in Tripoli, Lebanon. He remained there until 1950 when he returned to head office and in 1954 was appointed deputy general manager, Production Operations for Iraq Petroleum Company and its Associated Companies. Since then he has continued to hold this appointment.

T. C. Bailey, President of the Institute of Fuel, delivering his opening address

A Decade of Progress in Liquid-Fuel Firing

The Torquay Conference

In September 1948 a conference on Modern Applications of Liquid Fuel was organized jointly by the Institute of Fuel and the Institute of Petroleum and held in Birmingham. In order to review progress since that time and to bring the knowledge of oil-firing techniques up-to-date, the Institute of Fuel organized a conference on Major Developments in Liquid-Fuel Firing 1948–59 and this was held in Torquay over the period 11–14 May.

Nearly five hundred delegates registered for the Conference and at least twenty overseas countries were represented. Many of the delegates were accompanied by their ladies.

The Conference was formally declared open by the Mayor of Torquay, E. G. Milford, and the opening address was delivered by T. C. Bailey, president of the Institute of Fuel. He said that in the ten years since the last conference the overall consumption of gas, diesel, fuel, and tar oils had risen from 7·7 per cent of Britain's total energy needs in 1948 to 17 per cent in 1959. The most striking advances in the use of fuel oil since 1948 had been in steam-raising, both for general use and for generation of electricity for public use.

In 1948 the use of diesels for rail traction was only in the experimental stage. To-day there are 120 main line diesel locomotives and 1416 diesel rail coaches in use. Ultimately it is planned to have 2500 main line diesels and 4300 diesel rail coaches.

This scene at the opening meeting was typical of the attendance at all meetings

Rapid progress has also been made in the use of oil for central heating in industry and institutions and also for domestic water and central heating. The use of oil fuels for central heating has increased eightfold since 1948 and seems likely to continue.

After dealing with the present fuel situation, Mr Bailey said that, although world demand for oil would rise more steeply over the next twenty years, there should be no fear about supplies. All in all, he said, there is every reason for confidence in the ability of the international oil industry to maintain supplies of petroleum products, whatever the political or economic climate.

The Papers

The Conference had before it twenty-one papers and these were presented for discussion in seven sessions. Seven of the papers were devoted to ten-year reviews of developments in the use of liquid fuels in specific spheres of application. A general summing-up session, at which chairmen of individual sessions reported the results of the discussions, concluded the Conference.

Fuel Properties and Theoretical Considerations

The first session, under the chairmanship of T. C. Bailey, had before it three papers dealing with the properties of liquid fuels and some theories of their application.

In their paper **Properties of Liquid Fuels and Their Practical Application,** J. S. Wilding (*Shell-Mex and B.P. Ltd*) and E. Brett

Davies (*The Midland Tar Distillers Ltd*), discussed the British Standards for petroleum and coal tar fuels and considered the practical aspects of each class. A concluding section on choosing a liquid fuel contrasted the properties of both classes.

In **Atomization and Combustion of Liquid Fuel,** J. R. Joyce (*"Shell" Research Ltd*) and B. V. Poulston (*Shell International Petroleum Co. Ltd*) examined the extent to which knowledge of the liquid-fuel combustion process has been related to actual flames in industrial equipment. After discussing the many factors involved, they concluded that there have been notable advances but that much remains to be done in relating accumulated knowledge to full-scale flames in industrial plants.

The paper on **Design and Performance of High Momentum Oil Burners,** by F. A. Gray, G. R. Mattocks, S. Pilkington, and A. D. Robertson (*United Steel Companies Research and Development Department*), was later described by the President as one which would live in history for a long time as one of the classic papers on this subject. The authors considered the design of steam-atomized oil burners, such as are used in the open-hearth steel furnace, and examined its theory. This and experimental work was used to determine optimum nozzle profile and to study the effect of variables on performance, air entrainment, and flame length.

Aerodynamics, Flow Patterns, and Gasifiers

For this session the chairman was E. Brett Davies and the first paper to be presented was on **Aerodynamics of Open-Hearth Furnace Flames,** by C. Holden (*United Steel Companies Ltd*), who said that conversion to oil had resulted in from 50 to 100 per cent increase in output. He questioned whether anyone could yet state the correct open-hearth flame shape or the effect of impingement. He said that the convective component in heat transfer was as yet unknown and believed that the optimum burner angle was between 25 and 28 .

On the subject of **Pressure-jet Oil Burners for Boiler Use,** A. M. Brown (*University of Sheffield*) concluded that modern trends in pressure-jet atomizers used on boilers were towards higher combustion intensities, larger turn-down ratios with automatic control, and more efficient systems. He discussed the use of model techniques and burner performance and indicated the importance of aerodynamics in pressure-jet combustion.

At the Conference Dinner the toast "The Institute of Fuel", was proposed by W. A. Hubbard, C.B.E., president of the British Oil Burners Manufacturers Association

The Mayor of Torquay, who welcomed the delegates, with the President of the Institute of Fuel and its secretary, R. W. Reynolds-Davies, O.B.E.

The paper on **Flow Patterns as Affecting Open-Hearth Furnace Design,** by A. Hogg and C. Holden (*United Steel Companies Research and Development Department*) was presented by A. Hogg. He thought that recirculation reduced heat transfer, while gas streams carrying iron fume caused refractory wear. A partial cure might be to give directional bias to the combustion air and thus protect vulnerable areas. He also mentioned flow patterns in regenerators and the advisability of using guide walls to unify flow.

Professor M. W. Thring (*University of Sheffield*) summarized the paper on **Emissivity and Radiation of Steam- and Air-atomized Liquid-fuel Flames,** by C. Holden and himself. He reported on measurements being made at Sheffield and IJmuiden on diffusion of flames. Combustion in steam- or air-atomized flames was primarily dependent on rate of entrainment of surrounding low-velocity air. He put forward an equation expressing soot formation and combustion in terms of soot size and concentration and gas temperature. Practical applications included improved nozzle designs, carburizing of gas flames, and enrichment of liquid fuels with carbon. Results included increased production rates and fuel savings.

A paper on **Fuel-oil Gasifiers for Industrial Use,** by R. R. B. Cox and H. Johnson (*Esso Petroleum Co. Ltd*), was summarized by Mr Cox, who emphasized that the gasifiers under discussion were not for the manufacture of town's gas. These were in effect small oil burners which projected partly-burned products of combustion plus hot gases into the furnace to which they were attached. He described the principles of various types of gasifier and discussed their suitability for specific applications.

Oil-fired Works Boilers

This session, the chairman of which was Dr H. E. Crossley, was concerned with three papers on the general subject of works boilers. They were:

Oil-fired Works Boilers. By C. A. Roast (*Esso Petroleum Co. Ltd*)

A Summary of Operating Conditions in Shell Boilers. By D. J. Heslop (*National Industrial Fuel Efficiency Service*)

Packaged Fire-tube Boilers. By G. Whittingham (*British Petroleum Co. Ltd*)

Mr Roast thought that future trends in works boilers would be to convert solid-fuel boilers to burn oil fuel. He discussed fuel-oil distribution systems, the choice of oil burners, and other factors concerning boiler operation. He stressed the importance of burner choice and recommended the use of refractory linings for furnaces using heavy oils.

Reviewing operating conditions in shell boilers, Mr Heslop summarized results from surveys carried out by NIFES on 180 oil-fired boilers of various types. The conclusions reached showed that the standard of efficiency was not high and that savings could be made by improved operation and maintenance. Among the causes of inefficiency were admission of too much air, commonly through cracks in the setting, and excessive exit gas temperatures.

Packaged boilers, which are complete units comprising boiler, firing equipment, controls, and ancillaries, are one of the most striking developments in recent years, said Mr Whittingham. He discussed design features and performance and suggested that the important need was to marry oil-flame characteristics to boiler design.

Large Boilers and Corrosion Prevention

With G. H. Harford as chairman, the first paper in this session was on **Power Station Boilers,** by K. E. Dadswell and F. R. Thompson (*Central Electricity Generating Board*). They dealt with the problems which had been encountered in converting generating plant to oil-firing. The design of equipment was discussed and information given on the basis of decisions which influenced the designs of oil-firing plant. The most vital problem was the high sulphur of the fuel and its effect on the cooler heat recovery surfaces.

Dr H. E. Crossley (*Central Electricity Generating Board*), on the subject of **Prevention of Corrosion and Deposits,** first referred to air-heater blockage and corrosion in power stations in the U.S.A. and France. He then discussed British work on the effect of oxygen reduction in the combustion chamber, and of additives. Referring to the fouling of superheaters, which might become serious, he suggested limiting the sodium content of fuel oil to less than 10 parts per million.

Ten-year Reviews

Domestic Heating

One whole session was devoted to the review of **Liquid Fuels for Domestic Heating,** by K. H. Sambrook and N. M. Lawrence (*Shell International Petroleum Co. Ltd*), and this session was presided over by Mrs G. J. Gollin. This established a precedent for a technical meeting and the conduct of the meeting was a tribute to the lady-chairman.

Mr Lawrence presented the paper and said that the outstanding development in this field had been in the application of oil-firing to the small-capacity domestic boiler. Significant factors had been the change in comparative prices of solid and liquid fuels and the recent introduction of a light grade of oil for vaporizing burners. Many improvements had been made in design of burners and associated equipment and packaged boiler-burners were now available.

Metal and Glass Industries

Three reviews were discussed in this session, the chairman of which was Professor M. W. Thring.

Reviewing the ten-years progress in **Liquid Fuel for Open-hearth Furnaces,** R. Mayorcas (*John Summers and Sons Ltd*) said that automatic controls had rendered instrumentation very important. Combustion research had led to improved burners, simple in design, and jet and even oxygen-atomized fuel burners were possible. On the question of sulphur in fuel oils, he said that for low-sulphur steels, more would need to be known about sulphur pick-up or on how to inhibit or remove the sulphur cheaply.

E. Brett Davies (*The Midland Tar Distillers Ltd*) and A. B. Pritchard (*Shell-Mex and B.P. Ltd*), reviewing **Liquid Fuel in the Metal Industry,** considered that the major development had been in improving methods for obtaining temperature uniformity, especially with low operating temperatures. They discussed the progress in various metal industries and types of furnace and stressed the importance of technical consultation before final decisions are made on new installations.

Liquid Fuel in the Glass Industry was reviewed by W. R. Bulcraig (*Pilkington Brothers Ltd*), who dealt with the same subject at the 1948 Conference. He noted the use of pressure jet atomization, high-pressure air atomization, and a trend to the use of under-port firing. The use of oil-firing might necessitate higher grade refractories to avoid increased wear on furnace structure. During 1958 the cost of oil-firing had become less than producer gas in many furnaces and coal-to-oil ratios of 1·7 to 1·85 had been recorded. High vanadium oils had an adverse effect in glass tanks.

Ceramics, Gas Turbines, and Town Gas

This mixed session was presided over by Dr A. Parker, C.B.E. The first paper, by T. Chippindale (*Shell-Mex and B.P. Ltd*), was on **Liquid Fuel in the Ceramics Industry.** Here fuel oil usage had risen from about 20,000 tons in 1948 to 120,000 a year now. Details were given of combustion chamber and burner designs and it was shown how improved results had been obtained. Further expansion in the use of fuel oil in various applications is expected.

R. F. Darling (*Pametrada*), on **Liquid Fuel and the Gas Turbine,** said that to compete economically with other types of prime mover, the marine and industrial gas turbine must run on residual fuel oils. This raised the problem of fouling and corrosion by such inorganic substances as vanadium and sodium. Three methods of tackling the problem—combustion control, turbine cleaning, and additives—had failed to provide a universal solution. A combination of them might be successful with a suitable design of turbine.

On the use of **Oil and Its Derivatives for Town-gas Manufacture,** E. R. Ward (*South Eastern Gas Board*), said that the ten years had been a period of unprecedented change in the gas industry, with an increasing demand on oil to meet the demand for gaseous fuels. After discussing the developments in gas production from hydrocarbon gas and oil, the techniques of individual processes were described.

Discussion

At each session a considerable period was allocated for discussion and on each occasion was fully utilized. It is not possible in the space available to do more than mention some of the matters raised during the discussions.

In regard to specifications of fuel oils, a strong plea was made for the use of kinematic viscosities. It was suggested that, if the BSI specifications rounded-off the kinematic viscosities instead of the Redwood figures, something might be achieved. The President hoped that at the next conference, the question would be "What are Redwood seconds?"

On the subject of sulphur in liquid fuels there was considerable discussion and not a lot of agreement. Some concern was expressed that there would be a tendency for the sulphur content to increase, but the opinion was expressed by the authors of the first paper that this was not likely in the foreseeable future. In the discussion on glass furnaces it appeared that up to 2·5 per cent was acceptable, but for open-hearth furnaces the final answer was not known.

There was some discussion on the effect of vanadium in certain applications. It appeared to be important in glass tanks, although there was some disagreement as to the permissible limit.

In the session on domestic heating there was much discussion on the essential requirements of the domestic boiler from the viewpoint of the housewife. The ladies present at the meeting were requested, during the tea interval, to formulate their ideas in this direction. In due course, Mrs Thring (*chairman of the Women's Advisory Committee on Solid Fuel*) said that the basic requirements were:

No smell;
No noise;
No dirt;
Simple maintenance by user, male or female;
Absolute reliability.

It was also considered important that plumbers and small builders should receive instruction in the correct installation of oil-fired domestic heating units.

It was agreed by all that the Conference had been most successful and had provided a good opportunity for users and suppliers of oil fuel to get together and discuss their respective problems.

The final proceedings, which will incorporate all the papers and a full report of the discussion, will mark a step forward in the knowledge of oil-firing.

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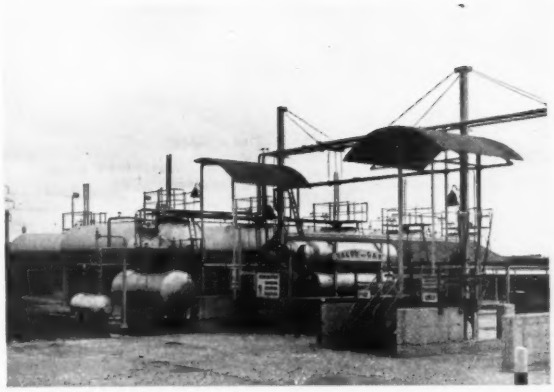
THE DISTRIBUTION OF LPG

At Millbrook, Southampton, the Calor Gas Company has transformed 9½ acres into the most up-to-date LPG filling plant in Europe. This plant serves all of southern England south of a line drawn from London to Bristol.

Millbrook was constructed in conjunction with Foster Wheeler Ltd, work beginning in April 1955 and on-stream production being under way by the end of May 1956. This depot supplemented the work of the two installations already operating at Saxham, near Bury St Edmunds, and Port Clarence, adjacent to the ICI hydrogenation plant at Billingham.

The butane or propane is delivered from the refinery and is placed in static cylindrical storage tanks. From there the gas is filled into the many shapes and sizes of containers available for use by industrial and private consumers.

A special feature of Millbrook, which is designed to handle 12,000–15,000 tons of butane and propane a year, is the application of automation to LPG on a scale that is quite unique; the mechanical handling of containers through the various stages from the receiving point where "empties" are isotope-tested for any quantities left over in the containers, through the washing and repainting processes, to the filling points, by means of powered chain, overhead, and portable power conveyors.



Bulk transport trucks discharging into storage tanks

At the filling point electronic weighing machines ensure accurate refilling, and reproduce the tally for each container on electronic recording machines in another part of the plant. This apparatus has been specially designed at considerable cost and is the first of its type ever to be used in an LPG plant.

The various stringent test precautions on the filled containers, in order to detect possible leaks, are likewise organized with a view to speed and the elimination of unnecessary heavy manual labour.

Up to 250 tons of butane-propane mixture, and a further 100 tons of the commercial propane, which is received from Fawley refinery, can be held in bulk storage facilities.

From the depot deliveries are made by either bulk road tankers, which include the new 10-ton bulk transporter—the first of their kind in Britain—or in any of the twelve different types of container available.

The Millbrook depot is a highly modern, streamlined plant, built to meet a market that is quietly but successfully expanding with a great potential for the future.

32-lb gas cylinders being filled by electronic control at the Millbrook plant

British Petroleum Company's 1958 Operations

In the British Petroleum Company's 1958 *Annual Report and Accounts*, the chairman, Sir Neville Gass, K.B.E., M.C., after reviewing the results of the year, made the following comments on the division of profits:

"The figures (£119 million in payment to producing countries under the fifty-fifty agreements, compared with the net income for the Group of £63 million) show that the fifty-fifty principle, and the manner in which it is applied, serve the producing countries well.

"For the assessment of the producing countries' 50 per cent profit share, the crude oil is valued at posted price, which is the published price available generally to buyers on a day-to-day basis. Large buyers prepared to contract with a supplier over a period naturally look for some discount; the result is that the average realization is below posted price on which the producing country's 50 per cent share of the profits is assessed. Moreover the fact that the assessment is made by reference to the crude oil price has sometimes been criticized as excluding the producing countries from any further profits made in activities outside the country, *i.e.* in refining and distribution in the consuming markets. The criticism lacks foundation in principle—there is no economic precept that the provision of a natural resource of raw material (be it crude oil or for example iron ore) should create a right to share in the earnings of the capital and effort devoted to transforming it into consumption commodities, and distributing those commodities to the user in other countries. That, despite this lack of essential foundation, such a view has been advanced, is presumably attributable to a mistaken belief that large extra profits are made in refining and distribution operations, so that concerns such as ours, which are involved in the whole range of operations from crude oil production through to distribution of products, derive an income much higher than that of the producing countries, from the crude oil which is the basis of the operations.

"The fact that the Group income of £63 million for 1958, mentioned above, includes our income from crude oil production, refining, transportation, and marketing, demonstrates how mistaken the belief is."

Production

In 1958 the Group's main sources of crude oil were again Iran, Iraq, Kuwait, and Qatar, from which 60·7 million tons were obtained. This was 12 million tons more than in 1957, when the Suez crisis had resulted in a drop of 1 million tons compared to 1956.

Details of the BP Group's shareholding in producing companies, and the total production by each company, are given in Table I.

Exploration

In Iran, exploratory drilling in the Ahwaz and Kuh-i-Binak areas continued, whilst in Kuwait, drilling at Minagish, in the south-western part of the state, was in progress.

The Khanaqin Oil Company's exploration and producing rights in the Naft Khaneh area were terminated in November by mutual consent with the Iraq Government, further exploration having failed to establish additional reserves on a scale large enough to undertake the export commitment defined in the 1951 Agreement.

Abu Dhabi Marine Areas Ltd, having completed their first offshore well, have also completed a second appraisal well, and are now drilling a third.

In the U.K., small discoveries in Lincolnshire and Nottinghamshire were made. Three wells were drilled on behalf of the Gas Council, one of which, in Derbyshire, was a small potential gas producer.

Permits for four areas totalling 16,000 sq km were obtained in the Sahara by the Group's associated company, Société des Pétroles de Valence, and exploratory work is in progress. Three test wells were completed in Libya, no production as yet being found.

In East Africa, the Tanganyikan deep test at Mandawa was bottomed at 13,325 feet, shallow drilling was carried out in Kenya, and geological work resumed in British Somaliland.

The finding of a substantial show of oil at Puri No. 1 well, in November, in Papua, persuaded BP to reverse its earlier decision to withdraw from active participation in

TABLE I

Company	*BP Group shareholding per cent*	*Total Crude oil production*	
		1958 *Tons*	1957 *Tons*
KUWAIT			
Kuwait Oil Company Ltd ...	50	69,117,000	56,376,000
IRAN			
Iraanse Aardolie Exploratie en Productie Mij NV (through Iranian Oil Participants Ltd)	40	39,780,000	34,765,000
IRAQ			
Iraq Petroleum Co. Ltd ...	23¾	22,633,000	11,657,000
Basrah Petroleum Co. Ltd ...	23¾	11,019,000	9,140,000
Mosul Petroleum Co. Ltd ...	23¾	1,280,000	564,000
QATAR			
Qatar Petroleum Co. Ltd ...	23¾	8,092,000	6,505,000
TRINIDAD			
Trinidad Petroleum Development Co. Ltd	77	726,000	637,000
Trinidad Northern Areas Ltd	33⅓	277,000	140,000
NIGERIA			
The Shell-BP Petroleum Development Co. of Nigeria Ltd	50	257,000	—
UNITED KINGDOM			
BP Exploration Co. Ltd ...	100	80,000	82,000
Scottish Oils Ltd (Shale Oil)	100	63,000	71,000
CANADA			
Triad Oil Co. Ltd	51½	104,000	94,000
GERMANY			
Gewerkschaft Norddeutschland...	100	4,900	3,900
SICILY			
Compagnia Idrocarburi della Sicilia D'Arcy SpA ...	100	4,300	—

the region. Although the well went to water under test, further appraisals of the area will be attempted.

Triad Oil Co. Ltd, in which BP has a 51·5 per cent interest, has acquired new areas in British Columbia, and the NW Territories. Five wells were drilling at the end of 1958, and a productive oil sand has been located in the Beatton River area of British Columbia.

Refining

In 1958 the Group's total refinery throughput was just below 38 million tons, some 6 million more than in 1957, which was adversely affected by the supply dislocations. Details are given in Table II.

Construction work on the Isle of Grain refinery expansion project was completed, and the new aviation gasoline plant was commissioned and in operation by the end of the year.

Grangemouth refinery capacity was raised to 3·2 million tons/year, and the new "super-tanker" jetty at Finnart was commissioned.

On the continent of Europe a hydrofiner and a catalytic reformer have been commissioned at Antwerp and the catalytic reformer is now in operation at Dunkirk. Construction has begun on the Dinslaken plant in the Ruhr.

Joint refinery projects under consideration, or for commencement shortly, are at Strasbourg, Algiers, and Turkey.

Following the sale of the BP associated marketing company in Israel, the associated refining company—Consolidated Refineries Ltd, the owners of the Haifa refinery—was sold at the end of the year.

Petroleum Chemicals

The expansion in the Group's manufacture of petroleum chemicals continued, both in quantity and scope.

In the U.K., the last quarter of the year brought a marked increase in demand, and sales of chemicals during that period were at the rate of 195,000 tons/year.

Work began in the autumn on the third cracker for BHC at Grangemouth. Further plants for the production of polyethylene, phenol, and acetone are due to begin operation this year.

The Naphtachimie SA plant, in France, had its production of ethylene and ethylene oxide increased considerably, and a new plant for the manufacture of polyethylene by the Ziegler process was commissioned.

In Germany, Erdolchemie GmbH (50 per cent BP Benzin und Petroleum AG), has recently commissioned its Lurgi cracker and Linde gas separation plants at Dormagen. Plants for the utilization of the olefins produced have also been commissioned, and further units are now under construction for scheduled completion towards the end of 1959.

Sea Transport

BP Group tankers totalled 157 ships of 2,600,000 dw tons at the end of 1958. A year previously the same number of vessels were recorded, but tonnage was only 2,411,000.

The totals were made up as follows:

	Ships	*dw tons*
BP Tanker Co. Ltd ...	123	1,802,000
BP Clyde Tanker Co. Ltd	10	138,000
Tanker Charter Co. Ltd	14	435,000
Société Maritime des Pétroles BP	10	225,000

Two vessels of 42,000 dw tons have been brought into service for Tanker Charter Co. Ltd, and since the end of 1958 BP Tanker Co. Ltd has taken delivery of one vessel of 35,000 dw tons.

Nordic Tankships I/S, the partnership between BP's Danish subsidiary and East Asiatic Co. Ltd, of Copenhagen, has two 35,000 ton tankers now in the BP service.

Two 35,000 ton vessels for delivery in 1960 to the Group, will be owned by Warwick Tanker Co. Ltd, a company formed jointly with Houlder Brothers and Co. Ltd.

The Group also has nearly 3 million dw tons of tankers on charter, about the same tonnage as a year ago.

TABLE II

Company	*Refinery location*	*BP Group shareholding per cent*	*Total throughput* 1958 *Tons*	1957 *Tons*
UNITED KINGDOM				
BP Refinery (Grangemouth) Ltd	Grangemouth	100	2,053,000	1,881,000
BP Refinery (Kent) Ltd ...	Isle of Grain	100	5,815,000	3,275,000
BP Refinery (Llandarcy) Ltd	Llandarcy	100	2,782,000	2,311,000
Scottish Oils Ltd	Pumpherston	100	143,000	151,000
ADEN				
BP Refinery (Aden) Ltd ...	Aden	100	3,758,000	4,240,000
AUSTRALIA				
BP Refinery (Kwinana) Ltd	Kwinana	100	2,691,000	2,287,000
BELGIUM				
Société Industrielle Belge des Pétroles SA	Antwerp	50	3,588,000	2,574,000
FRANCE				
Société Française des Pétroles BP	Dunkirk	70	2,117,000	1,677,000
	Lavera	70	2,997,000	1,900,000
GERMANY				
BP Benzin und Petroleum AG	Hamburg	100	1,627,000	1,266,000
Oelwerke Julius Schindler GmbH	Hamburg	97	306,000	165,000
IRAN				
Iraanse Aardolie Raffinage Maatschappij NV (through Iranian Oil Participants Ltd)...	Abadan	40	14,986,000	15,202,000
ISRAEL				
Consolidated Refineries Ltd	Haifa	50	1,190,000	1,052,000
ITALY				
Industria Raffinazione Oli Minerali SpA	Venice	49	1,385,000	1,370,000
KUWAIT				
Kuwait Oil Company Ltd ...	Kuwait	50	5,939,000	1,352,000
LEBANON				
Iraq Petroleum Company Ltd	Tripoli	23½	305,000	495,000

Sales

BP sales of crude oil and products in 1958 totalled 62 million tons, the figure for the second half of the year being a little above that for the first six months.

Capital Expenditure

Total capital expenditure, in 1958, including that for non-consolidated subsidiaries and the Group's proportion of expenditure by allied companies, was made up as follows:

	1958 £	1957 £
Exploration and production	39,000,000	23,250,000
Refineries	40,000,000	38,500,000
Tankers*	23,750,000	21,250,000
Distribution and marketing facilities	34,750,000	30,500,000
	137,500,000	113,500,000

* Before deducting sales under tanker finance arrangements.

Notes of the Month

The Fiftieth Year of Iranian Oil

1958, the Iranian oil industry's half-century year, witnessed further considerable expansion in its oil economy. The revenues from oil now, at over 18,532 million rials in 1958, form two-thirds of the country's total budget. Oil is responsible for three-quarters of her foreign exchange.

This, then, is the immediate and most tangible benefit gained by Iran from her oil industry, as is shown in the *Review of 1958* of the Iranian oil operating companies—Iranian Exploration and Producing Company and Iranian Oil Refining Company.

In spite of the general recession in world economic activity during the year, the production of crude oil once again showed a considerable increase, rising from 34·8 million long tons in 1957 to 39·8 million.

Of this total, 23·8 million tons were exported from Bandar Mashur, compared with 18·9 million in 1957; 13·2 million tons (13·8 million in 1957) were delivered to refinery for export; and 2·4 million (1·9 million) was retained for internal consumption.

The search for additional reserves continued and survey parties were active throughout the Agreement Area. Nine development wells were completed during the year at locations at Naft Safid, Agha Jari, and Gachsaran. Agha Jari No. 53, which flowed at a rate of 40,000 bd on test, is one of the world's largest productive oil wells. Exploration drilling was continued at Ahwaz and was started at Kuh-i-Binak.

Ahwaz No. 6 blew out while being drilled at a depth of 8093 feet, and caught fire. The fire was extinguished by surface means, and the well capped sixty-five days after it had caught fire. A new drilling rig was later erected and drilling was resumed.

Increases in production were obtained from the established fields of Lali, Haft Kel, Naft Safid, Agha Jari, and Gachsaran. The largest percentage increase came from Agha Jari which supplied 60 per cent of total production. With the completion in 1958 of production unit No. 3 and the 16–20-inch pipeline to Bandar Mashur, the capacity of the Agha Jari field was raised to some 600,000 bd.

The development of Gachsaran was of increased importance in the sphere of 1958 operations. The work involved included the modification of production unit No. 1 to increase its capacity to 150,000 bd and the construction of production unit No. 2 with the same capacity, together with the H_2S removal plants. These are scheduled for completion in the third quarter of 1959.

The 26–28–30-inch pipeline from Gachsaran to Kharg Island, which is planned for completion late in 1959, has an initial designed capacity of 330,000 bd. In 1958 preliminary work was carried out on its 99-mile route over extremely difficult terrain.

During the year under review, the emphasis so far as the Kharg Island loading facilities part of the project were concerned, was on providing the necessary temporary installations and utilities required for the construction of the oil loading terminal and associated facilities, for completion early in 1960.

The Abadan refinery processed 310,000 bd of crude oil in 1958, a similar rate to that of 1957. In September a 30,000-kW turbo-alternator increased the electrical generating capacity of the refinery, and a second of similar size, is now under construction for operation early in 1960.

A great deal of attention is given in the *Review* to the activities of the personnel of the countries: housing and amenities; education and training; and medical services. The figures of the increasing number of education courses—from university scholarships to technician and artisan training schools—are particularly impressive, and indicative of how the needs of both the Companies and the people of Iran are benefiting by the increase in knowledge.

Polyisoprene Rubber in Commercial Production

Polyisoprene rubber, the man-made duplicate of tree-grown rubber, is going into commercial production and use for the first time. This is regarded as a highly significant event for the rubber industry, and of vital importance from the military standpoint.

United States Rubber Co. has begun the production of truck tyres made of polyisoprene rubber, which is manufactured by Shell Chemical Corp, for sale at a price which is competitive with that of the natural product.

The commercial availability of polyisoprene rubber will free the United States completely from dependence on foreign sources of natural rubber in times of emergency. It is also expected to have a strong stabilizing effect on natural rubber prices and will allay doubts as to whether the supply of plantation rubber can keep pace with rapidly-growing world demands.

U.S. Rubber has adopted, and expects to extend, the use of polyisoprene rubber as rapidly as its production will permit. Scientists in the Company's tyre development laboratory in Detroit have developed new compounding techniques and a special process to shorten its curing time, give better adhesion, and adapt it to normal tyre-building operations.

Shell Chemical Corp will manufacture and sell the new material under the trade name *Shell Isoprene Rubber*. It is currently being produced by part-time utilization of commercial equipment located at various Shell Chemical and Shell Oil Company installations in the Los Angeles area. The current price of *Shell Isoprene Rubber* is 30 cents/lb fob Torrance, Calif., approximately equivalent to that for the better grades of the natural product.

For the present, output will be maintained at a rate averaging five tons a day; but as installation of plant progresses during the year, the effective capacity is expected to increase steadily to 15,000 to 20,000 tons annually.

The synthetic is a duplicate of the best grade of natural rubber. Since it is made by a chemically-controlled process, it is much more uniform in quality, and of higher purity, than plantation rubber.

The new polymer has been thoroughly tested in the laboratory and on the road, where truck tyres made of polyisoprene have proved to be equal, and in some cases superior, to those made with natural rubber. Further refinements and modifications are expected to increase its quality lead over the natural product.

In addition to truck tyres, a market awaits the new synthetic in huge tyres for earth-moving equipment and aircraft tyres, and in many other applications.

New Zealand's First Oil Refinery

Construction is expected to begin at an early date on New Zealand's first oil refinery, and a survey is to be undertaken immediately to decide upon a suitable site for it. To be built by Shell at an estimated cost of approximately £17 million, the new plant will have an annual capacity of 2 million tons.

A new refinery company is to be formed and part of its capital will be offered to private New Zealand investors.

In preparing its plans, Shell has had to overcome certain unusual problems—New Zealand's peculiar pattern of demand, which is complicated by disproportionately high consumption of petrol, and its geographical position, which militates against the economic export of surplus products. In addition, the refinery has been designed with sufficient flexibility to process a wide variety of crude oils including, so far as possible, any that may in future be found within the country, if the present search, in which Shell is also participating, meets with success.

Hydrodesulphurizer at Shell Haven

Now under construction at Shell Haven refinery, at a cost of more than £2 million, is a Hydrodesulphurizer for the removal of sulphur from petroleum products by the Shell "trickle-phase" technique. This technique was the basis of the first unit of this type which came into operation at Stanlow refinery in 1955. Developed by Royal Dutch/Shell research technologists at Amsterdam, this technique has since been successfully applied in many refineries round the world.

In this operation, gas oil to be desulphurized is contacted with hydrogen and made to trickle over a special catalyst. The hydrogen, which will be drawn from the Platformer unit at Shell Haven, converts the sulphur compounds into hydrogen sulphide which will be processed to make some 20 tons/day of pure liquid sulphur.

Shell Haven refinery recently brought on stream a second large distillation unit, which raised the annual crude throughput capacity to some 8 million tons and boosted the total throughput of Shell's four U.K. refineries to some 15 million tons per year.

New BP Tanker

The sixth 42,000 dw tons tanker for the BP Tanker Company was launched on 22 May from Harland and Wolff's shipyard at Belfast, and was named *British Power*.

Lummus Contract in Mexico

Petroleos Mexicanos announced on 11 May that a contract was awarded to The Lummus Company for approximately $21 million for expansion of Pemex's Salamanca refinery, and for a 220 tons/day anhydrous ammonia plant also at Salamanca.

Lummus will design, engineer, handle procurement in the United States and abroad, and supervise the construction of these installations.

The anhydrous ammonia plant is part of Pemex's programme for production of petrochemicals, and the refinery expansion is part of Pemex's current enlargement of facilities to keep up with Mexico's growing demands for gasoline, distillates, and vehicular and industrial fuels.

The refinery expansion consists of an atmospheric and vacuum distillation unit, catalytic cracking, gas recovery, catalytic polymerization and treating units, revamping of some existing process facilities, as well as various offsite additions.

British Equipment for Mexico

G. V. Sims, managing director of British Oil Equipment Credits Ltd, signing the three and a half million pounds agreement with Petroleos Mexicanos for British petroleum equipment. With him on the left is the Director of Pemex, Senior Ingeniero Pascual Roldan, and the British Ambassador to Mexico, Sir Andrew Noble

By the terms of the agreement made between British Oil Equipment Credits Ltd, (subsidiary company of the Council of British Manufacturers of Petroleum Equipment) and Petroleos Mexicanos (PEMEX), petroleum equipment to the value of £3,500,000 will be purchased in Great Britain for the construction of a platforming unit for the Minatitlan refinery in Mexico. It is estimated that enquiries will commence to flow towards the end of July.

The design, engineering, and procurement will be carried out by Fluor Engineering & Construction Co. Ltd, who are taking offices at 26 Finsbury Square, London, E.C.2.

Officials of PEMEX, now on their way to London, will open an office at the same address.

First Stage of Montreal Refinery Complete

The first stage in the construction of BP's new Canadian refinery at Ville d'Anjou, near Montreal, is complete. Its main aim has been to provide tankage and loading facilities so that products can be stored and distributed to BP's growing Canadian market. For this purpose 48 miles of pipeline have been laid and 22 storage tanks erected. In addition, site clearing, ditching, drainage, and road building work over the whole area of the refinery has been completed.

The second stage of the construction programme includes the erection of the processing units to deal with a crude throughput of 1 million tons/year, and is due for commissioning in mid-1960. Until then crude oil is being processed into BP products under a contract with a nearby refinery.

Milford Docks Developments

Recently F. G. Mitchell, chairman of the Milford Docks Company and head of the Mitchell Engineering Group, speaking at a meeting in London, referred to proposals to expand the facilities at Milford to provide dry docks and repair facilities for the largest tankers and ore carriers. He referred to the jetties being built by the Esso Petroleum Company and the British Petroleum Company, both of

which would be able to accommodate the largest tankers afloat.

It was also said that the Milford Haven Storage and Pipeline Company was negotiating to buy fifteen 4000-ton underground oil storage tanks owned by the Air Ministry. The Company was also acquiring land to expand its sto age to 300,000 tons.

A film is being prepared of "The Milford Haven Project" and its premiere is expected during August.

Pipelined Products for Manchester

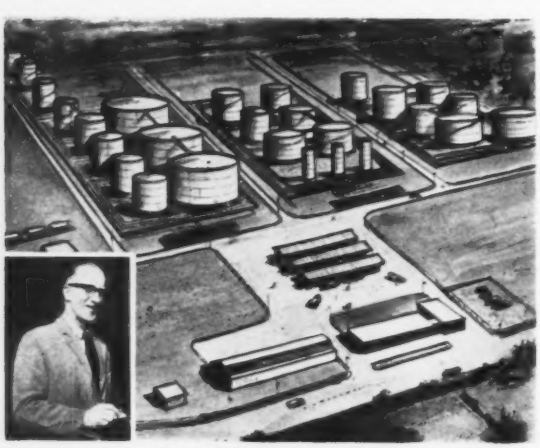
It is expected that by early next year Manchester will receive a part of its oil supplies directly by pipeline. At that time the new Partington installation of Shell-Mex and B.P. Ltd will be operating, with petroleum products being pumped 23 miles from the Stanlow refinery at Ellesmere Port.

Construction work on the new installation, ten miles south-west of Manchester, began recently. The laying of two underground pipelines from Stanlow has also begun and are expected to cost over £1 million.

The installation, the first distributing centre owned by Shell-Mex and B.P. Ltd to be supplied entirely by pipeline, will take over distribution from the present 60-year-old Eccles depot, which is fed by road and water from Stanlow. Products will be delivered by road tankers into a 1200-square mile area of Lancashire, Cheshire, Derbyshire, and Yorkshire.

The manager of Shell-Mex and B.P.'s North Western Division, C. S. Martin, in the inauguration ceremony at Partington, said that the two pipelines would run alongside others serving the Carrington works of the Shell International Chemical Company. The new installation was to help meet the increasing demand in the area for petroleum products. In the north-west, oil consumption was expected, in 1959, to be over one million tons for the first time. Consumption of motor spirit was now at the rate of about 260,000 tons a year, whilst fuel oil demand was about 550,000 tons a year—nearly five times the figure of ten years ago.

An artist's impression of Shell-Mex and B.P.'s Partington installation when completed, and (inset), *Frank Miles, an installation foreman, who has the longest service*—41 *years*—*in the North-West Division and who formally started the work on driving in the first pile*



New Water Speed Record

Blue Bird *pictured on Coniston Water in the process of breaking the record*

Donald Campbell, the fastest man on water, set up a new world water speed record on 14 May, on Coniston Water, in the Lake District, driving his jet-propelled craft *Blue Bird*. He beat his own record of 248·6 mph with a new figure of 260·35 mph.

This was his fifth record in five years and the last one he is to attempt on water in Britain.

SONJ Report for 1958

For the first time in its 76-year history, the Standard Oil Company (New Jersey) organization last year sold more than 1,000 million brl of petroleum products and, although 1958 earnings were down about 30 per cent from 1957, an upward trend in total revenues and rate of earnings was noted at the end of 1958. This trend has continued into the current year, the company reports.

In the 1958 annual report it is stated that Jersey's sales volume in the first three months of 1959 was higher than for any corresponding period in the past. Consolidated net income in 1958 for SONJ was $562,475,000, or $2·72 per share, based on the average number of shares outstanding during the year. Earnings for 1957 were $805,177,000, or $4·08 per share.

The major factors causing the decline in earnings, the annual report said, were lower crude oil and petroleum product prices, and an increase in the Venezuelan income tax. This tax increase alone accounted for a reduction in consolidated earnings of $89,200,000, or 43 cents per share.

Revenues from sales and investments totalled $7,712,257,000, which is $266,057,000 less than the total revenues in 1957.

United States and foreign governments, through various tax levies, benefited from the operations of Jersey and its affiliates to the extent of $2,355,200,000 in 1958, an all-time record. Such tax levies in 1958 were equivalent to $11.40 per share—more than five times the dividend payments to shareholders and more than double the employee payroll and benefit costs.

Multi-Grade Petrol Pumps for BP Germany

A new type of pump which dispenses a blend of ordinary and premium grade petrol to the customer's requirements has been introduced by BP's German associated company at a number of its service stations.

The motorist can choose between blends containing 25, 50, or 75 per cent premium petrol, and the pump automatically delivers the desired mixture and calculates the price.

BP is the first oil company to use a mixer pump outside Canada and the United States. The pump itself is being produced by a German manufacturer and is the first of its kind to be introduced in Europe.

New German Petroleum Chemicals Plant

The first four of a number of new petroleum chemical production units being built for Erdolchemie GmbH (BP Benzin und Petroleum AG and Farbenfabriken Bayer AG) at Dormagen, near Cologne, have been commissioned.

Ethylene, and a variety of other gases used as basic chemical raw materials, are being produced from a cracking plant and gas separation plant. Another cracking unit is being erected and the output of ethylene from both plants will total about 45,000 tons/year. The major part of the ethylene produced will be transformed to ethylene oxide in two plants, the first of which has been commissioned. They will have a total capacity of about 36,000 tons/year of ethylene oxide. The balance of the ethylene will be used for the manufacture of synthetic ethyl alcohol.

A large part of the ethylene oxide produced is being processed in a glycols plant. The product from this plant may be used in the manufacture of anti-freeze, plastics, and synthetic fibres. The high-octane gasoline produced in the process is sold to BP's German marketing company.

Feedstock for the plants is at present being supplied from a variety of sources, but eventually will come from BP's refinery being built near Dinslaken.

Fuelling Modern Jet Airliners

Advance research is today playing a more and more vital rôle in the many new and difficult problems connected with the rapid, economic, and safe fuelling of the huge jet aircraft now being introduced on the world's airlines.

Part of the aviation research now being conducted at Thornton Research Centre, Shell's major laboratory in the U.K., is directed towards developing airfield fuelling equipment to meet the ever-changing demands of new types of airliners.

Much of the work is common both to fuelling by mobile vehicles and by hydrants, although the latter introduced their own special engineering problems.

Modern jet airliners, like the Boeing 707 and the Douglas DC-8, which consume up to 2000 gallons of fuel an hour, may require fuel uplifts of some 16,000 gallons. These large quantities of fuel need to be delivered, using underwing pressure fuelling, at the rate of 1000 gallons/min, in order to keep ground time to a minimum.

These requirements will be met by Shell using either large mobile fuelling vehicles of up to 10,000 gallons capacity, or by hydrant systems capable of pumping at the rate of 4000 gallons/min when servicing four aircraft simultaneously at large, busy airports.

Royal Society of Arts Offer of Prizes

The Royal Society of Arts are offering the following prizes during 1959: Howard Prize of £50 for Mechanical Motive Power, and Fothergill Prize of £20 for Fire Prevention or Fire-Fighting.

The Howard Trust was established for the purpose of making periodic awards to the authors of treatises on steam or other motive agents.

Under the Fothergill Trust a prize is offered for a descriptive essay or model embodying some new idea for the prevention or suppression of fire.

Type-written entries for the prizes must be received by the Secretary of the Royal Society of Arts, 6-8 John Adam Street, Adelphi, London, W.C.2, not later than 31 July 1959.

Oil Discovery in Kuwait

On 18 May Kuwait Oil Co. Ltd completed a successful test of their exploratory well at Minagish, 21 miles west of the Burgan oilfield.

This well, which was spudded in on 4 October 1958, has found oil in the Ratawi limestone formation at a depth of nearly 10,000 feet. A five-foot perforated interval produced 1660 barrels of oil a day through a $\frac{3}{8}$-inch wellhead choke, with a flowing pressure of 600 psi.

Tests indicated that the gravity of the oil is about 34·5 API, and that the sulphur content is 1·9 per cent by weight.

The well is to be drilled still deeper to investigate the production possibilities of the underlying Arab Zone limestones.

Bitumen in Paper Bags

Multi-wall paper bags are now in use as an alternative and entirely new method for delivering certain industrial grades of bitumen in the U.K. This product is usually delivered to the customer in bulk form, but there are those who have no facilities for receiving hot bitumen in bulk, or who prefer to receive solid bitumen, either in packages or in blocks. For many years the traditional package has been the 35-gallon steel drum, which has not always been ideal for all customers.

Shell's Stanlow refinery has recently introduced 1-cwt paper bags made up of four layers of paper, the inside layer being specially treated to prevent adhesion to the bitumen, while the outside layer is water resistant. The paper bags are filled with liquid bitumen while supported in formers which are designed to ensure that air circulates freely around the bags to assist cooling and can be readily dismantled to remove the bags.

The paper bag strips easily, leaving a clean and conveniently-sized block of bitumen.

CBMPE Chairman's Report

The Chairman's report on the work of the Council of British Manufacturers of Petroleum Equipment in the period July–December 1958 contains several interesting items.

The work of the CBMPE at several important industry gatherings is reviewed; namely the Chemical and Petroleum Engineering Exhibition held last year in London, the forthcoming Fifth World Petroleum Congress, and the joint CBMPE/FEPEM Petroleum Equipment Technical Congress to be held in Paris in July of this year.

The work and organization of the FEPEM, the European representative of the petroleum equipment manufacturers, is explained, and other subjects included in the report are a survey of recent equipment development in the oil industry, sundry world oil statistics, and a review of drilling and pipeline operations in certain areas.

Bahrain Branch Symposium

and

Annual Dinner

The largest gathering of Persian Gulf oil men for many years recently took place under Bahrain Branch auspices on the occasion of the Symposium and 3rd Annual Dinner held in late January 1959.

Members and guests of the Branch flew in on 28 January from places as far apart as Das Island, Iraq, Kuwait, Lebanon, Qatar, and Saudi Arabia.

An unofficial reception was held in the evening when Bapco management met members, wives, and guests of the Bahrain Branch.

The Symposium

The Symposium was opened on 29 January by M. H. Lipp, vice-president of the Bahrain Petroleum Company Ltd, who welcomed the guests with the words that it was a pleasure to see so many members from other companies in the Gulf as the guests of his Company. He hoped that there would be a fruitful exchange of information and that the members would enjoy themselves while on Bahrain. He also expressed the hope that there would be other gatherings of a similar nature.

Archaeology

After the opening address, H. A. McCulloch, manager–relations, gave a talk, fully illustrated by coloured slides, on the history of Bahrain. Knowledge of the island was now being extended through the archaeological efforts of the Danish Archaeological Expedition into the Sumerian times of pre-history. Slides were shown of the excavation at the temple at Barbar and also underneath the ruins in the old Portuguese fort. Archaeological interest had always been extended to Bahrain on account of the numerous tumuli, situated mainly on the northern end of the island, the number of which had been estimated to be up to 250,000, but all of which appeared to have been robbed very early on in their existence. From the earliest times, Bahrain always appeared to have been a centre of trade, a watering port for dhows, possibly an exporter of dates, and certainly the centre of the Middle East pearl industry. Pearl fishing in the Persian

Pictured at the cocktail party (from left): *L. D. Josephson, general manager Bahrain Petroleum Co., M. H. Lipp, Bapco vice-president, and H. G. Babbage, chairman of the Bahrain Branch*

Members of the Kuwait Branch of the IP arrive at Muharraq Airport. Bahrain Branch honorary secretary, D. G. Johnstone (left) *greets J. R. L. Stephens, Kuwait Branch chairman, vice-chairman D. G. Hitt and Mrs. Hitt, and hon. secretary G. A. Lee*

R. Milne talking with Mrs J. Jefferson, with Mrs A. H. R. Grimsey in the background

FURTHER GROUPS AT THE COCKTAIL PARTY

George Beeby-Thompson in fine form with Mrs C. E. Davis (left), *and Mrs M. A. R. Gardiner*

(From left): *Mrs J. Jefferson, H. J. Baker, and P. T. Cooper*

(Below, left to right): *S. B. Ford, H. St. V. Longley-Cook and N. R. Pocock*

(Below, left to right): *J. B. Sagar, G. A. Lee, C. E. Davis, and M. H. Lipp*

Gulf was restricted by law and treaty agreement to skin diving without artificial aids, and pictures were shown of the divers at work. Coming to more recent times, Mr McCulloch showed pictures of the Bahrain Government projects, including a teachers' hostel, new hospital building, and other progressive works.

Petroleum Production

The Bahrain Field was next briefly described by R. E. de Mestre, chief geologist. His talk was illustrated by photographs of equipment in current use, by a stratum contour map of the main producing horizon, by sections, and the local stratigraphic column.

The Bahrain structure was a simple anticline with its centre eroded, leaving a distinctive rim rock of Damam formation. Surface mapping was on the Shark's Tooth Shale, a thin band below the top of the rim rock, which was not sufficiently displaced anywhere to indicate faulting. However, an oil seepage in the southern end of the main oilfield must obviously be the result of fracture and there was definite evidence of missing sections in the electric logs of wells which indicated up to 70 feet of displacement at or above the Orbitolina Limestone.

187 wells had been drilled in the Bahrain field, of which 147 were producing oil, 4 gas, and 4 were gas injection wells. The area of the field was about 10 miles by 2½. Present

Two groups enjoying the luncheon after the Symposium: (left to right) *Mrs D. G. Johnstone, B. C. Hyde, George Beeby-Thompson,* (*back to camera*) *D. G. Johnstone, and Mrs R. E. de Mestre*

. . . *and* (from left) *Mrs M. A. R. Gardiner, R. Milne* (*Branch vice-chairman*), *Mrs J. Jefferson, and C. E. Davis*

production rate was 45,000 bd of oil, and water produced with the oil was separated at the well head in knock-outs. Oil was collected from field wells into a 6-inch trunk system to five tank batteries which shipped the crude to the refinery through 8-inch lines.

The drilling of a Bahrain well was complicated by a high rate of corrosion in the upper hole and by the fact that the producing formations would not hold a full column of cement to the surface. The practice of employing liners and cemented topping-out strings was therefore in vogue. The average depth for the Bahrain Zone producing wells was approximately 2300 feet. Three deep tests had been drilled, all ending up in the Permo-carboniferous at 10–12,000 feet. Only gas reserves had been discovered in them.

Reservoir engineering showed that the best method of production was by gas displacement, and gas had for many years been injected into the main producing horizon. The movement of the expanding gas cap in the reservoir was followed by pressure recordings and, at required intervals, by running tubing Neutron surveys.

Refining

The growth of the Bahrain refinery from its origin as a 2000 bd topping plant on the site of what is now Tank Battery No. 1, to one of the larger refineries in the world (200,000 bd throughput) was traced by N. E. Watson, manager of refining. The refinery occupied a site on the north-east coast of the island and included a fluid catalytic cracking unit which was modernized from a wartime installation for the production of aviation gasoline, but which actually was never utilized for this purpose. The most recent addition had been a Unifiner–Platformer for the production of premium motor fuel. In addition to the normal distillation and re-run units, the refinery had a separate asphalt plant and an individual drum-manufacturing unit. Electric power was generated on site, utilizing gas-fired steam boilers.

The ancillary services necessary to such an operation, such as maintenance workshops, technical services, inspection, and engineering were all located in the refinery area.

Employee Amenities

The Symposium was concluded with a talk by V. W. Herzig, supervisor of Housing Services Division, who detailed the employee amenities in Awali for the 1000 expatriate staff and their families who lived in the oilfield village, and the 2000 rupee payroll and Bahraini staff who were provided for during working hours. Thus, in Awali itself there were some 600 family houses, each with a permanent occupant, and 30 families moving through houses not permanently assigned. There were also approximately

Mrs H. G. Babbage, Sir George Middleton, HBM Political Resident in Bahrain, and H. G. Babbage, chairman of the Branch, at the Annual Dinner

Top table at the Annual Dinner

300 bachelor-status employees, housed in Company accommodation varying from self-contained flats to 4-bedroomed bungalows. In the rupee housing area some 830 rooms were available, mainly for expatriate staff, it being the policy of the Company to encourage Bahrainis to live in their own villages, and assistance being given to them to build their own houses. The normal sports of cricket, football, tennis, hockey, etc., were catered for, and swimming pools and cinemas had been provided in each of the housing areas.

Following the description of the facilities necessary to keep Awali running, the party was taken on a tour to the cinema, the dining halls and kitchens, the library, and the ionics plant, where, by electro-dialysis, drinking water was produced from the comparatively brackish waters pumped from wells in the Damam formation acquifer.

Following this tour, lunch was served and the guests then had a free afternoon for shopping in nearby Manama and preparing for the evening's activities.

The Annual Dinner

Thursday evening brought the highlight of the convention, the 3rd Annual Dinner and Dance at Awali Hall, at which HBM's Political Resident, Sir George Middleton, K.C.M.G., was the guest of honour, and a record attendance of 83 members and 25 guests filled the hall to capacity.

Sir George Middleton, in proposing the toast to the Institute, said that despite his short length of service in Bahrain he felt quite at home amongst oil men, as his previous diplomatic service in Rumania and South America had led him to many pleasant contacts with the oil industry. He went on to say that he was continuously impressed by the way in which oil companies not only thrived in the highly technical and commercial sphere in which they operated, but also passed on the benefits gained from such enterprises to their locally-engaged employees.

The chairman, **H. G. Babbage,** in replying to the toast to the Institute, referred to the formation of the Institute and subsequent changes undergone to achieve its present form. After recalling the objects of the Institute, the chairman expressed the wish that the bringing together of people from various companies in the Persian Gulf area on the occasion

of this Symposium and Dinner would provide an opportunity to exchange ideas and experiences which could, in many ways, benefit the oil industry as a whole.

The toast to the guests was proposed by **G. J. R. Tod**, acting general manager, Qatar Petroleum Co. Ltd, and replied to by **A. H. R. Grimsey**, general manager, Basrah Petroleum Co. Ltd.

The dinner was followed by a dance, organized by the MC, Dick de Mestre, who was energetically assisted by George Beeby-Thompson.

The programme was concluded on the following morning, when the visitors were conducted on tours of the refinery, wharf, and fields areas by H. G. Babbage and L. J. Kelly, superintendent, technical services, and production superintendent, respectively of the Bahrain Petroleum Co. Ltd.

The afternoon saw reluctant departures being taken by the visitors, who had so obviously enjoyed such an interesting and stimulating weekend, made possible by the splendid co-operation of Bahrain Branch members, and the support received from the Bahrain Petroleum Company Ltd.

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Around the Branches

ABADAN, BAHRAIN, ESSEX, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD, YORKSHIRE

Bahrain Branch

At the April meeting of the Bahrain Branch G. W. Stockwell of the Arabian American Oil Company described the Ain Dar gas injection plant from design to subsequent operation. It was, he said, the largest construction project Aramco had ever undertaken, with the one exception of the refinery project in 1945.

He outlined the purposes of the installation as:—

(1) To conserve the gas content in the oil reservoir;
(2) To sustain productivity of the wells;
(3) Ultimately to increase the total amount of oil recoverable.

The plant compressed gas in five stages from 150–2100 psig, at which it was injected into the reservoir; the five stages were—150–250 psig, 250–400 psig, 400–650 psig, 650–1100 psig, and 1100–2100 psig; 5 Clark 2-shift gas turbine-driven barrel compressors were utilized to process 200 million s cu ft day, which was calculated to realize a production rate of 175,000 barrels.

The total cost of the installation was $30 million, of which the plant itself cost $24 million, the balance being expended on the additional work involved: 38 miles of pipeline to collect gas from widespread separator plants; the conversion of the plants to electric power; the laying of lines to carry pressurized gas to appropriate points above the reservoir; and wells to carry the gas into the reservoir.

The project, which covered a plot size of 460 × 600 feet, was visualized in model form at a cost of 8000 dollars. Mr Stockwell pointed out that the benefits of this expenditure were still being felt with the help the model was providing in the plant's present initial period of operation.

The official opening took place on 25 February 1959, and after 250 hours of operation a scheduled shutdown came into force for an overall general check-up. At the time of Mr Stockwell's talk the plant was due to start up again any day.

A shift of two staff operators and four general workers under a plant foreman was the only operating crew required on the project. The central control room was situated in the mezzanine building on the operating floor which was 14 ft above ground level.

The control room, instrument and switch gear galleries, and small maintenance workshop have an air conditioning unit of 80 tons capacity, whilst the rest of the building has fans giving a complete air change every three minutes or approximately 1400 million s cu ft day of freshly-filtered air.

A very busy question time followed, at which M. A. Kearney, also of Aramco, assisted with statistical information; questions dealing with gas turbine lubricating oil viscosities, plant maintenance techniques, cooling problems with high ambient temperatures, condensate recoveries and start-up and shutdown procedures were amongst the many put to them. A vote of thanks proposed by the chairman, H. G. Babbage, and carried with loud and prolonged applause, brought to an end a most fruitful and stimulating evening.

Yorkshire Branch

A meeting of the Yorkshire Branch held on 9 April at the Metropole Hotel, Leeds, was attended by 90 members and visitors. The Branch chairman, G. J. Vineall, presided, and introduced R. C. Hartley of the Wool Industries Research Association, who gave a talk on "Textile Oils—with Special Reference to Mineral Oils."

After briefly describing the processes and raw materials used in the worsted and woollen industries Mr Hartley listed the traditional fibre lubricants, which are fatty oils for worsted and oleines for woollen fibres. He then discussed the use of mineral oils, to which a strong prejudice exists in the trade—mainly because of staining and scouring problems.

A suitable mineral lubricant should be based on a highly refined oil, preferably water white in colour, and the most popular type of added emulsifiers were the non-ionic surface active agents of which about 20 per cent was required to ensure adequate removal of the oil in the scour. In some cases, however, mineral oils gave better results than fatty oils.

Mr Hartley also mentioned other materials, such as polyethylene glycols, which are being suggested as fibre lubricants, and at the end of his talk answered many questions. R. G. Prophet proposed a vote of thanks.

World Tanker Statistics First Quarter 1959

The number of oil tankers under construction in the world totalled 329 ships of 5,226,548 gross tons during the first quarter of 1959, according to the recently published *Lloyds Register Shipbuilding Returns* covering that period. This was 270,622 tons below the figure for the previous quarter and represented 52·3 per cent of the total tonnage of merchant shipping under construction in the world.

The ratio of steam as opposed to motor propulsion increased slightly once again. There were 159 steam tankers, of 3,755,375 tons, under construction, compared with 170 motorships of 1,471,173 tons.

In Britain, 74 tankers of 1,091,791 gross tons were under construction at the end of March, which is 27,596 tons more than in the last quarter of 1958, and represents 48·5 per cent of the total under construction in the country.

Once again Britain is the leading country of tanker registrations with 85 ships of 1,365,033 gross tons. Second place is taken by Liberia with 27 vessels totalling 667,245 tons; third is Norway with 31 ships of 476,895 tons, just ahead of the U.S.A.'s total of 21 ships of 476,078 tons. Among these leading countries only Britain and the U.S.A. have increased their tonnages. Full details can be seen in Table I.

Britain also achieves her usual eminence in the list of countries with tankers under construction. Japan displaces

TABLE I

REGISTRATION OF OIL TANKERS UNDER CONSTRUCTION AT END-MARCH 1959

Country of registration	*No.*	*Gross tonnage*	*Country of build*	*No.*	*Gross tonnage*
Britain ...	85	1,365,033	Britain ...	67	1,006,741
			Belgium ...	3	51,876
			France ...	1	22,000
			Germany ...	4	46,166
			Italy	9	211,800
			Sweden ...	1	26,450
Canada ...	3	49,800	Commonwealth	2	48,000
			Netherlands ...	1	1,800
Other Commonwealth	2	1,590	Britain ...	1	990
			Commonwealth	1	600
Argentina ...	1	1,600	Unspecified ...	1	1,600
Belgium ...	1	11,760	Britain ...	1	11,760
Brazil ...	4	84,139	Japan ...	1	21,000
			Netherlands ...	3	63,139
Czechoslovakia	1	13,339	Yugoslavia ...	1	13,339
Denmark ...	9	145,585	Britain ...	1	22,300
			Denmark ...	6	110,300
			Germany ...	1	285
			Japan ...	1	12,700
France ...	11	260,222	Denmark ...	1	18,300
			France ...	10	241,922
Germany ...	20	131,078	Germany ...	20	131,078
Iran	1	21,000	Netherlands ...	1	21,000
Irish Republic	1	12,000	Britain ...	1	12,000
Italy ...	17	250,098	Italy	17	250,098
Japan ...	22	211,415	Japan ...	22	211,415
Kuwait ...	1	27,650	Japan ...	1	27,650
Liberia ...	27	667,245	Belgium ...	2	31,500
			France ...	1	43,000
			Germany ...	3	93,713
			Japan ...	8	190,427
			Netherlands ...	3	46,000
			Sweden ...	2	50,000
			U.S.A. ...	6	177,605
			Yugoslavia ...	1	13,500
			Unspecified ...	1	21,500
Netherlands	20	229,676	Germany ...	7	5,246
			Netherlands ...	13	224,430
Norway ...	31	476,895	Britain ...	2	25,500
			Denmark ...	1	12,300
			Germany ...	1	25,300
			Netherlands ...	4	50,970
			Norway ...	12	186,870
			Sweden ...	11	175,955
Panama ...	13	297,400	Italy	5	101,000
			Japan ...	6	153,100
			Netherlands	1	16,300
			U.S.A. ...	1	27,000
Peru ...	1	4,297	Unspecified ...	1	4,297
Poland ...	2	25,868	Poland ...	1	12,600
			Yugoslavia ...	1	13,268
Portugal ...	2	29,585	France ...	1	13,585
			Unspecified ...	1	16,000
Russia (U.S.S.R.)	4	13,320	Finland ...	4	13,320
Spain ...	11	124,810	Spain ...	11	124,810
Sweden ...	8	142,465	Germany ...	1	20,900
			Sweden ...	7	121,565
Switzerland ...	2	1,400	Germany ...	2	1,400
U.S.A. ...	21	476,078	Germany ...	1	23,600
			Japan ...	1	26,000
			Sweden ...	2	78,270
			U.S.A. ...	17	348,208
Venezuela ...	2	44,000	Japan ...	2	44,000
Yugoslavia ...	2	18,200	Yugoslavia ...	2	18,200
Unspecified ...	4	89,000	Britain ...	1	12,500
			U.S.A. ...	2	60,500
			Unspecified ...	1	16,000

Of the 329 oil tankers under construction, totalling 5,226,548 gross tons, 210 of 3,058,134 are for registration in country of build.

Germany for second place in the actual number of vessels building, with 42 compared to the latter's 40. Table II lists tankers under construction, with their country of build and type of propelling machinery.

TABLE II
OIL TANKERS UNDER CONSTRUCTION AT END-MARCH 1959

Country of build	Steam		Motor		Total	
	No.	Tons gross	No.	Tons gross	No.	Tons gross
Great Britain & N. Ireland ...	37	823,425	37	268,366	74	1,091,791
Other Common-w'lth Countries	2	48,000	1	600	3	48,600
Argentina ...	—	—	1	1,600	1	1,600
Belgium ...	2	40,376	3	43,000	5	83,376
Denmark ...	1	24,500	7	116,400	8	140,900
Finland	—	—	4	13,320	4	13,320
Formosa ...	1	21,500	—	—	1	21,500
France	8	202,537	5	117,970	13	320,507
Germany (West)	13	314,913	27	32,775	40	347,688
Greece	—	—	1	16,000	1	16,000
Italy	24	546,000	7	16,898	31	562,898
Japan	22	572,682	20	113,610	42	686,292
Netherlands ...	14	283,709	12	139,930	26	423,639
Norway ...	1	18,500	11	168,370	12	186,870
Peru	—	—	1	4,297	1	4,297
Poland	—	—	1	12,600	1	12,600
Portugal ...	—	—	1	16,000	1	16,000
Spain	1	22,000	10	102,810	11	124,810
Sweden	8	225,720	15	226,520	23	452,240
U.S. of America	25	611,513	1	1,800	26	613,313
Yugoslavia ...	—	—	5	58,307	5	58,307
World Total ...	159	3,755,375	170	1,471,173	329	5,226,548

During the first quarter of 1959 Britain commenced 11 tankers, launched 11, and completed 9. Japan commenced 35, launched 30, and completed 33. Germany commenced 17, launched 18, and completed 15. Sweden (a noteworthy increase) commenced 7, launched 6, and completed 9.

Details of launchings appear in Table III.

TABLE III
OIL TANKERS LAUNCHED DURING THE FIRST QUARTER 1959

Country of build	Steam		Motor		Total	
	No.	Tons gross	No.	Tons gross	No.	Tons gross
Great Britain & N. Ireland ...	4	84,250	7	27,310	11	111,560
Other British C'lth Countries	—	—	—	—	—	—
Argentina ...	—	—	—	—	—	—
Belgium ...	1	21,876	—	—	1	21,876
Denmark ...	—	—	1	22,000	1	22,000
Finland	—	—	1	3,330	1	3,330
Formosa ...	1	21,500	—	—	1	21,500
France	1	22,067	1	30,800	2	52,867
Germany (West)	5	78,800	13	10,094	18	88,894
Italy	4	92,200	1	12,900	5	105,100
Japan	8	204,332	22	42,255	30	246,587
Netherlands ...	4	78,609	3	38,030	7	116,639
Norway ...	—	—	2	31,640	2	31,640
Portugal ...	—	—	1	12,000	1	12,000
Spain	—	—	—	—	—	—
Sweden	2	60,770	4	38,659	6	99,429
U.S.A.	5	133,903	—	—	5	133,903
Yugoslavia ...	—	—	1	13,268	1	13,268
World Total ...	35	798,307	57	282,286	92	1,080,593

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British Chemical Plant Manufacturers Association

The Thirty-ninth Annual General Meeting of the British Chemical Plant Manufacturers Association was held in London on 30 April 1959.

The retiring chairman, H. W. Fender, M.Inst.B.E., A.C.I.S., vice-chairman and managing director of Prodorite Ltd, was re-elected for a further year. The following were elected to the Council:

P. D. Doulton	Matthew Hall & Co. Ltd
E. S. Franklin	Torrance & Sons Ltd
N. C. Fraser	W. J. Fraser & Co. Ltd
Dr R. Lessing C.B.E.	The Hydronyl Syndicate Ltd
R. C. Odams	Constructors John Brown Ltd
B. N. Reavell	Kestner Evaporator & Engineering Co. Ltd
R. W. Rutherford	The Power-Gas Corporation Ltd
P. W. Seligman	The APV Co. Ltd
R. F. Stewart	Dorr-Oliver Co. Ltd

At its quarterly meeting after the Annual General Meeting the Council elected the following officers:

Vice-chairmen: N. C. Fraser
Dr R. Lessing, C.B.E.
P. W. Seligman

Hon treasurer: M. H. Wyndham, Bennett, Sons & Shears Ltd

The Annual General Meeting was followed by a private dinner discussion of members, the subject being "The Association's Service to Members". During the dinner a presentation was made to Mrs K. Gwynn Jones, who recently retired from the post of commercial officer after eighteen years' service with the Association.

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Middle East Oil Production

	April	Jan–April
	Tons	
Iraq Petroleum Co. Ltd ...	2,074,659	8,199,004
Basrah Petroleum Co. Ltd ...	1,034,100	4,102,739
Mosul Petroleum Co. Ltd ...	106,384	427,061
Qatar Petroleum Co. Ltd ...	662,284	2,648,949
Iraanse Aardolie Exploratie en Productie Mij	3,444,000	13,892,000
Kuwait Oil Co. Ltd	6,436,249	23,118,429
	Barrels	
Arabian American Oil Co. (Saudi Arabia)	31,292,991	129,188,974
Bahrain Petroleum Co. Ltd ...	1,352,151	5,424,217

The refinery throughput at Abadan of the Iraanse Aardolie Raffinage Mij for April was 1,188,000 tons, the total for 1 January to 30 April being 4,889,000 tons.

Crude processed at Aramco's Ras Tanura refinery during April was 4,463,800 brl, the total for 1 January to 30 April being 21,218,062 brl.

Oil deliveries from Sidon, Lebanon, by Trans-Arabian Pipeline Co. in April were 8,820,757 brl, the total for 1 January to 30 April being 46,612,864 brl.

Atomic Energy for Petroleum Production

U.S. Bureau of Mines Work

Speaking at the annual meeting of the North Texas Oil and Gas Association in March, Carl C. Anderson, Chief Petroleum Engineer of the U.S. Bureau of Mines, said that the petroleum industry was interested in the possible use of atomic energy in the production of oil and gas, in the recovery of oil from tar sands, and in its application to oil shale. The Atomic Energy Commission and the Bureau are co-operating in the study of the use of nuclear explosives in mineral development under the" Plowshare" programme.

The programme includes projects for the breaking and heating of oil-bearing rocks and for the fracturing of oil shale either for mining or for thermal recovery by combustion *in situ*.

Rainier Test

The first fully-contained underground nuclear detonation—the Rainier Test—was made in September 1957 and four underground devices were detonated in October 1958. Data from these tests are not yet complete.

The energy released by Rainier shot was equal to 1700 tons of TNT, or 1·7 kilotons. The total release of 6800 million Btu is approximately equal to the energy released in burning 6·8 million cubic feet of natural gas. The device was placed in a mesa at a vertical distance to the surface of 899 feet and at 790 feet from the nearest surface at the sloping face.

Rock formation is Oak Springs tuff, underlain by limestone. Cap rock of the mesa is a welded tuff 250 feet thick, porosity 15–25 per cent, and low permeability. The 600-ft interval below the cap rock is mainly granular volcanic material, porosity 25–35 per cent, containing 15–20 per cent water by weight, with 25–35 per cent of the voids connected.

The horizontal tunnel terminated in a spiral designed to collapse and seal itself before any radioactive materials could escape. The device was in a 6 x 6 x 7-foot room, the entrance being plugged by 13 feet of sandbags. Two steel doors to withstand a pressure of 75 psi were placed at 575 and at 1275 feet from the detonation point. Firing was by remote control from 2·5 miles distant. Above the shot, the top of the mesa rose 9 inches and at horizontal distances of 1000 feet, vertical uplift was less than 0·5 inch. Radioactivity was contained. The tunnel was intact to the 575-foot door, at 400 feet from the device there was considerable spalling, and at 200 feet it had collapsed.

A hole drilled from the top of the mesa struck a cavity 386 feet above the detonation point, the cavity being 25 feet deep and conical. The space to the floor of the test room was filled with broken tuff and sand. Holes were drilled into the cavity region from a point in the tunnel 211 feet from the detonation point. Radioactivity was concentrated in a bowl-shaped shell, of about 55 feet radius and comprised of fused glass-like material, and which trapped and retained almost all the radioactivity. Highest temperature was 194°F.

Events following the explosion have been reconstructed. After firing, calculated temperature in the test room was 1,000,000°K (about 1,800,000°F) and pressure 7,000,000 atm. The shock vaporized rock to 3 feet radius, melted it to 15 feet, crushed it to a radius of about 130 feet, and the molten sphere expanded to a radius of 55 feet in several milliseconds. The 55-foot sphere was then lined with 4 inches of molten rock at 2200–2730°F, this rock coming from the 15-foot sphere. Steam from the water originally in the tuff filled the 55-foot sphere to about 40 atm pressure, causing the cavity to stand for ½ to 2 minutes and long enough for molten rock to drip from the ceiling and flow down the sides. Then the cavity collapsed, the steam expanded, and cooling became rapid.

Some 200,000 tons of broken rock filled the cavity and the rapid cooling to 210°F (b.pt of water at 6600 ft) converted the molten rock to glass containing all radioactive fission products except rare gases.

Yields of the four nuclear detonations in 1958 ranged from 65 to 23,000 tons. Placed at various depths in relation to strength of energy released, it was found that in the kiloton and above range the complete containment of all radioactive material can be expected for depth (in feet) 450 times the cube root of the kiloton yield. At 290 times there was 0·1 per cent escape and from 1 to 2 per cent for depths of 210 times.

Also of interest to the petroleum engineer is the fact that one-half of the total energy of the device remains in the cavity and crushed material as heat. The crushed zone, 55–130 feet, in the Rainier test had little or no permeability but the fractured or broken zone is permeable to water. The shape of the crushed and fractured regions was 110 feet horizontal and 386 feet vertical.

Oil Shale Experiment

In the Plowshare programme, preference was given to oil shale as much more was known of rock characteristics.

The Green River oil shales of Colorado, Utah, and Wyoming are very dissimilar in properties to the Oak Springs tuff. The oil shale has compressive strengths of 15,000 to 25,000 psi against 5000 to 10,000 psi for the tuff. Based on the Rainier test, the 10-kiloton yield would give a crushing radius equal to 130 feet times the cube root of the yields; this equals 235 feet. Oil shale is probably twice as strong as tuff and crushing radius is calculated to be about 166 feet. Experience indicates a crushing zone radius ranging from 100 to 200 feet. On a radius of 100 feet, approximately 300,000 tons of shale would be shattered. If half of the energy released by the device, *i.e.* 20,000 million Btu, is used in retorting average oil shale at 900°F it would produce 10 million cubic feet of gas and 15,000 brl of oil.

A cost estimate for the whole experiment is about $2,600,000.

Shale Oil Cost Estimates

Estimates have been prepared on the basis of a 300 kiloton or larger device to shatter 35 million tons of oil shale which might assay 28 gallons/ton. For the sinking of a 72-inch hole drilling costs of $200 and $400 feet were used and details of other requirements and expenditures were given by Mr Anderson. Capital expenditures for the two conditions are $6,170,000 and $4,730,000, or $2.90 and $2.35 a barrel for shale oil. By suitable programming and amortization, the costs, including normal profit, may be between $2 and $3 per barrel.

Petroleum Reservoirs

The Bureau has given some consideration to the use of nuclear explosives in petroleum reservoirs. The first test might conceivably be in a newly-discovered or an old reservoir with a pay section of 100 to 200 feet and a high saturation of viscous crude. The device should be detonated below the oil-producing section at a point where the rock has a satisfactory silicate section to fuse and retain radioactive products. The cap rock should not be broken and the structure should have edge and water conditions that will not cause adverse conditions in producing the property after detonation.

Mr Anderson concluded by saying that engineers of the Bureau would confer with oil operators on the feasibility of using this new device.

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Personal Notes

Thomas C. Barger has been elected president of the Arabian American Oil Company in succession to **Norman Hardy**, president since January 1958, who has been elected chairman of the board of directors to succeed the recently retired Fred A. Davies. Mr Hardy will continue as chief executive officer.

John Noble, president of the Trans-Arabian Pipe Line Company, has also been elected to the Aramco board.

Mr Barger, who is a graduate of the University of North Dakota, joined Aramco as a geologist in 1937, before the Company made its first discovery of oil in commercial quantities in Saudi Arabia in 1938. He transferred to government relations work in 1941, and later became Aramco's director of local government relations and representative to the Saudi Arab Government. Since 1958 he has been a vice president, assistant to the president, and a director.

Mr Hardy, who joined Standard Oil Company of California in 1926 as a geologist, is a veteran of service in Indonesia, the Netherlands, and South America as well as the United States. He was president of the Richmond Exploration Company before joining Aramco in 1951.

Mr Noble served as an associate general counsel of Aramco prior to assuming the presidency of Tapline in 1956. His headquarters will continue to be in Beirut, Lebanon.

In addition, **Shaikh Hafiz Wahba,** Saudi Arabia's Ambassador-at-large to the Arab world, and **Shaikh Abdallah H. Tariki,** Saudi Arabia's Director-General of Petroleum and Mineral Affairs, have been elected to the board of directors of Aramco.

The new directors were added to the Aramco board in keeping with an agreement between the Saudi Arab Government and the Company that the Government should have representation upon the board.

Hafiz Wahba has had a long career in the diplomatic service of Saudi Arabia. Born in Cairo, he studied at al-Azhar University there and graduated with a degree in Islamic law from the Muslim Jurisprudence College. Later he served as counsellor to the late King 'Abd al-'Aziz ibn Saud and, from 1924 to 1927, as Governor of Mecca. From 1927 to 1929 he was Minister of Education and assistant to the Viceroy of the Hijaz. From 1930 on he represented Saudi Arabia at the Court of St James', first as Minister and then as Ambassador, until the rupture of diplomatic relations with Britain in 1956 during the Suez crisis.

Abdallah Tariki has been active in Arab League oil affairs and headed the Saudi Arab delegation to the First Arab Petroleum Congress in Cairo last April. Born in al-Zilfi in Saudi Arabia, he was educated in Egyptian primary and secondary schools and graduated in 1944 from what is now the University of Cairo with a B.S. degree in geology and chemistry. Between 1945 and 1949 he studied for his M.A. in geology at the University of Texas, and worked as a trainee with Texaco Inc in West Texas and California. Shortly thereafter the Saudi Arab Ministry of Finance appointed him director of the newly-created Oil Supervision Office in the Eastern Province and, in 1955, to his present post.

The Lummus Company, New York, announces the election of **C. Frank Corbin** as comptroller, and **Richard J. Hallinan** as secretary, of the firm.

Mr Corbin joined Lummus in 1955 after being a partner in the public accounting firm of Hackeling, Oberkirch, Corbin and Company. He is a New York certified public accountant.

C. F. Corbin

R. J. Hallinan

Mr Hallinan joined Lummus in 1958 as counsel after being associated with the law firm of Shearman and Sterling and Wright. He served for two and a half years as special assistant to Commissioner Thomas E. Murray of the United States Atomic Energy Commission, and is a member of the New York Bar Association.

Sharples Centrifuges Ltd announce the appointment of **Edward C. C. Harvey** as senior project engineer responsible for the Company's activities in south-east England.

Before joining Sharples Mr Harvey was originally with The British Petroleum Company Ltd at Abadan refinery, and more recently with Shell-Mex and B.P.

E. C. Harvey

Ralph Pease, general manager of Trade Lubricants Ltd, has been appointed to the board of directors.

The **Rt Hon the Earl of Halsbury,** F.R.I.C., F.Inst.P., has joined the board of Head Wrightson Processes Ltd.

Elliott-Automation Ltd announces that **Donald M. Hughes,** the export sales manager of the Fisher Governor Company, has joined James Gordon Valves Ltd of Airport Works, Rochester, Kent, as sales manager.

Mr Hughes has been with Fisher's since 1952 and has travelled extensively for that Company throughout the world.

Lord Rothschild has joined the board of "Shell" Research Ltd as part-time adviser on research.

He is a Fellow of the Royal Society and an assistant director of research in the Department of Zoology, Cambridge University; until recently, he was chairman of the Agricultural Research Council, a post he occupied for ten years.

It was not until the 1939–1945 war that the name of the present Lord Rothschild became widely known as a scientist, although he had already done distinguished research work in biophysics in Cambridge, being elected a Fellow of Trinity College in 1935. Most of his work during the war years remains secret. It is known, however, that he worked on bomb disposal. He was awarded the George Medal in 1944 for "dangerous work in hazardous circumstances". After the war, Lord Rothschild went back to Cambridge University and was able to pursue and direct scientific research.

Among other official positions, he has been a director of BOAC.

Producers Pipelines Ltd, Regina, Saskatchewan, announces the election of **D. B. Furlong** as president and general manager of the Company. Mr Furlong was also elected vice-president and general manager of Westspur Pipe Line Company.

The retiring president, **C. Hay**, of Royalite Oil Company Ltd, has been elected chairman of the board.

D. B. Furlong

Mr Furlong is a professional engineer and a graduate of Oxford University, and was previously assistant manager of The Imperial Pipe Line Company Ltd, in Edmonton.

He is president of the Edmonton Pipeliners Club and has been actively engaged in the oil industry in the Middle East and Canada since 1941.

L. T. Monson

Louis T. Monson, general manager of Tretolite Company of California, division of Petrolite Corporation, has been named a vice president of Petrolite.

Prior to his appointment as general manager of Tretolite Company of California in December of 1957, Mr Monson had served as chief chemist and research director of the California division.

Newton D. Baker, director of employee and public relations for Black, Sivalls & Bryson Inc, manufacturers of oilfield equipment, has been elected to the newly-created post of marketing vice president.

He will also continue his responsibility for all public and employee relations activities.

Mr Baker joined the Company in 1950 as assistant advertising manager, became advertising and sales promotion manager a year later, and was promoted to director of employee and public relations in 1958.

OIL AND BRITISH INDUSTRY

The oil industry is now an integral and very important part of Britain's economy, said C. M. Vignoles, C.B.E., M.A., managing director of Shell-Mex and B.P. Ltd, and president of the IP, speaking at the annual luncheon of The Institute of Fuel in London on 23 April. The benefits it brought to the economy were "more than sufficient to establish beyond all doubt the right of this particular fuel industry to work and trade in this country unhindered by preferential barriers of any kind."

"As a nation we live by our exports, and as exporters we live in a severely competitive world. The British business man must keep his production costs as low as possible, and in particular he must have access to the cheapest sources of raw materials and fuels.

"Here is the only possible basis for our national fuel policy. Our fuel industries—all of them—exist primarily to keep British manufacturing industry at the peak of competitive efficiency, and for that reason it is the British manufacturer and no one else who should decide his own fuel needs. Any arbitrary and artificial adjustment, made in the supposed interests of one fuel industry or another, will impair that freedom of choice and thereby also impair the efficiency on which depend all our national hopes of increasing prosperity in the future."

Mr Vignoles said that the British oil industry could fairly claim to have been guided consistently by the principles of commonsense fuel selection and efficient fuel usage. "We have never suggested that oil would or should meet all the increasing demand for energy, but only that it can make an important and extensive contribution, and primarily where its special properties give it definite advantages in terms of production efficiency.

"Those advantages have now been firmly established in many industrial applications of vital importance to our economy where it is clear by now that a reversion to any other fuel would mean an inevitable and appreciable handicap to the industries concerned."

Mr Vignoles went on to describe the size and value of Britain's holding in the international oil industry, a holding which had been growing steadily in recent years. To-day British companies were concerned in producing about one-third of all the oil entering international trade. On the marketing side they and their associates handled up to 50 per cent of the world trade outside the U.S.A. and U.S.S.R.

The major refining industry created in Britain since the war was now an essential part of British industry and its productive capacity. By reducing Britain's expenditure of foreign currency, and also by their exports, the refineries had made a substantial contribution towards a favourable trade balance.

Mr Vignoles emphasized the importance of the oil industry as a customer of British industry generally, particularly of shipbuilding and engineering. Last year over a third of the merchant shipping tonnage completed in U.K. shipyards consisted of oil tankers. Apart from tankers, the oil companies had spent £600 million in Britain in the past five years on the purchase of other petroleum equipment.

Mr Vignoles concluded, "The efficiency and prosperity of our fuel industries is a problem to be tackled in terms of their ultimate service to our national life, and not in negative and restrictive terms of their impact on each other."

Books and Films

Fifty Years On

The year of 1759 has been termed "The Year of Victories." Two hundred years later, that of 1959 might well be deemed "The Year of Anniversaries," for not only is being celebrated the anniversary of an event of no little importance to the world, one which occurred at Titusville, Pennsylvania, but this year is, amongst other birthdays, the half-century of what is now known as The British Petroleum Company Ltd.

Fifty years ago, on 14 April 1909, the Anglo-Persian Oil Company was born, as a result of the momentous finding of oil by G. B. Reynolds at Maidan-i-Naftun in May of the previous year. As an appropriate measure to mark the occasion of the half-century, two books have recently been published which record the activities of BP.

The first, *Adventure in Oil** is subtitled, *The Story of British Petroleum*. It tells, for the first time in any great detail, the story of the search for oil in Persia prior to the 1908 discovery, of the foundation of the Company, and of how the organization which had sprung from such relatively small, yet portentous, beginnings grew to one of the largest oil companies in the world, whose activities can now be said, with the recent agreements with Sinclair Oil Corp, to span the globe.

A very appropriate foreword is supplied by Sir Winston Churchill (for it was he, when First Lord of the Admiralty, who was responsible for the British Government becoming a stockholder in Anglo-Persian), and in the ensuing pages the story is unfolded by Henry Longhurst, the noted author and journalist of the greens, with a profusion of photographs.

The book is essentially an immensely readable *story* and is not presented as an historical chronicle. As such it should prove extremely popular not only with oil men, but also with anyone of the general public who has an interest in history of any sort, for the fifty-year history of BP is really the record of the revolutionary era that formed the modern industrial age.

The second anniversary publication, entitled *BP Fifty Years in Pictures*, presents the growth of the Company in a most absorbing pictorial form, from its valuable collection of photographic records which date back over the full half-century. This 150-page glossy presentation is published by The British Petroleum Company itself.

World Motor Gasoline Survey

The 1959 edition of The Associated Ethyl Company's booklet, *World-wide Survey of Motor Gasoline Quality*, again gives a detailed coverage of the properties of the motor gasolines of over 150 countries.

For each country information is given, for super, premium, and regular grades where applicable, on octane numbers (research and motor methods), TEL content, vapour pressure, specific gravity, sulphur content, distillation characteristics, and the size of the total market in the country.

Conversion tables are supplied, covering volume-weight, temperature, pressure, and comparative TEL concentrations.

* By Henry Longhurst, and published by Sidgwick and Jackson, price 21s.

Gasification Methods

The Gas Committee of the OEEC have published a bibliography on gasification methods entitled *Documentation sur les Techniques et L'Economie des Divers Procédés de Gazéification*. This presents a detailed list of publications on the subject in the various countries of the OEEC area. The subject is divided into several sections, such as general studies, distillation, gasification, utilization of liquid and various products, gas treatment, economic questions, etc.

NBS Standard Materials

The National Bureau of Standards, have published a new circular* which lists the standard materials issued by the Bureau and their prices. Information on certified compositions and properties and purchase procedures are given.

The National Bureau of Standards began issuing standard materials in 1905 and this has grown through the years in response to the demands of science and industry, to the point where now the Bureau supplies more than 550 different standards of metals, ores, ceramics, chemicals, hydrocarbons, and radioactive materials.

About 250 of the samples are of certified chemical composition; some 100 of these have been prepared specifically for use in spectroscopic analysis. Other standard materials include those certified for such properties as acidity (pH), viscosity, melting point, density, index of refraction, and heat of combustion; more recently, a number of radioactive materials, uranium isotopes, lithium ores, aluminium refractories, and phosphor materials have been added.

Some of the principal uses of NBS standard materials are: checking analytical methods; standardizing solutions for volumetric analysis; developing new or improved methods of analysis; and calibrating and standardizing many laboratory and plant instruments.

Alaskan Crude-Oil Analyses Published

Detailed analyses of 20 crude-oil samples collected in recent years from five areas of Alaska's arctic slope are given in a Bureau of Mines sales publication released by the Department of the Interior.

The samples were from oil and gas wells in the Barrow Lakes, Umiat, Cape Simpson, Fish Creek, and Wolf Creek areas, and exhibit wide chemical and physical variations. They were obtained by the U.S. Navy's Office of Petroleum and Oil Shale Reserves and by Interior's Bureau of Indian Affairs. Since one purpose was to inform the Navy about the quantity and quality of petroleum products obtainable from Alaskan crude oils, the Bureau of Mines produced and tested gasolines, diesel fuels, and other products from some of the samples.

One portion of the publication describes physical characteristics of seepage samples collected much earlier along the arctic slope by a Bureau of Mines reconnaissance party.

A copy of Report of Investigations 5447, *Analyses of Some Crude Oils from Alaska*, can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., for 25 cents a copy.

* National Bureau of Standards Circular 552, Third Edition, price 35 cents, obtainable from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Foreign remittances must be in U.S. exchange and should include an additional one-fourth of the publication cost to cover mailing.

Alberta Research Council Report

The Thirty-Ninth Annual Report, for 1958, of the Research Council of Alberta has recently been published.

The work of the Petroleum Division is fully described, many investigations having taken place during the year on different subjects. The study of sulphur in heavy oils has been further developed. The engineering group has continued its work on the flow of liquids and solid particles, with the completion of initial and intermediate stages of projects in pipe flow, flow in sediments, and shearing flow of oil-wet sands. Petroleum geochemistry investigations have resulted in the completion of field migration studies and the initiation of work on chlorophyll conversion. Hydrocarbon pyrolysis research has described isotope effects in the pyrolysis of ethyl bromide.

In 1958, two basic projects were pursued in the sphere of petroleum reservoir engineering. The first was on the effect of initial rock conditions, particularly gas saturation and the method by which it is formed, on the ultimate recovery of oil by water flooding. The second project was concerned with the effect of miscible slug quality on the efficiency of a miscible fluid displacement. Later in the year three more investigation programmes were begun on the subjects of the effect of bacteria on injection waters in flood problems; the effect of free gas saturation on the sweep efficiencies of well patterns; and displacement mechanisms in heterogeneous rocks.

The Natural Gas Section has completed and published its studies on nitrogen-methane mixtures. The use of gas chromatography as a technique for the study of absorbents has been extended, and an investigation into absorption of ethylene from mixtures with ethane has been started. Hydrocarbon pyrolysis research was almost entirely concerned with the further development of the autothermic surface combustion reactor for pyrolyzing hydrocarbons.

The work of the Geology Division is given under the sub-sections: ground water section, industrial minerals, iron deposits, mineralogy, petrology, Pleistocene, stratigraphy, sedimentation, drilling operations, etc.

Further sections of the report include a recording of the activities of the Soils Division, highway research, the gasoline and oil-testing laboratory, industrial engineering services, industrial pollution, and the Lloydminster study. The Report is obtainable, price 5 cents, from the Librarian, Research Council of Alberta, 87th Avenue and 114th Street, Edmonton, Alberta.

Translations of Russian Chemical Journals

Starting with the January 1959 issue, The Chemical Society is to publish, with the support of DSIR, a translation of the monthly journal, *Zhurnal neorganicheskoi Khimii*, a publication of the Academy of Sciences of the U.S.S.R. The translation will be undertaken for the Society by Infosearch Ltd, and the Society has appointed Professor P. L. Robinson as executive editor of the publication. Professor Robinson will be assisted by an advisory panel of distinguished inorganic chemists.

The sale and distribution of the journal will be undertaken by Cleaver-Hume Press Ltd, 31 Wright's Lane, London, W.8, from whom a detailed prospectus giving the scope of this journal may be obtained.

Translations will be issued in monthly parts as soon as possible after the Russian original is available. The subscription rate will be £30 (U.S.A. $90) per annum, but universities and technical colleges may subscribe at a discount of 25 per cent. Single issues can be purchased at £4 ($12) per copy to all purchasers.

The Society also hopes to start the publication within the next year of translations of the Russian *Journal of Physical Chemistry* (*Zhurnal fizicheskoi Khimii*) and *Progress in Chemistry* (*Uspekhi Khimii*).

Proceedings of International Cybernetics Congress

The International Association for Cybernetics has decided to publish the proceedings of the Second International Congress on Cybernetics, which took place in Namur from the 3–10 September 1958.

This important work will comprise more than 900 pages of well-presented texts, in French or in English according to choice.

A subscription list is now open, and the price before the 31 August 1959, when the list officially closes, will be 1000 Belgian francs. Orders will, however, be accepted after that date, at 1200 Belgian francs.

Further information and subscription forms may be obtained from the Association Internationale de Cybernétique, 13 Rue Basse-Marcelle, Namur, Belgium.

"Pumping"

This new publication first appeared in January and is to be issued monthly. It is intended that it should be devoted exclusively to the subject of pumping and the first issue has an "Introduction to Pumping" and articles on centrifugal and positive displacement pumps and on pump operations. Yearly subscription is 40s and it is published by Trade and Technical Press Ltd, 1–9 Tudor Drive, Morden, Surrey.

Lubrication Films

Lubricants With Care and *Compressor Lubrication* are two new films available on loan from Industrial Division Offices of Mobil Oil Company. They are sixth and seventh in a series of industrial films made by the European group of Mobil Associates (United Kingdom, France, Germany, and Italy). Both films were made on the Continent and won awards in their respective countries. The first, made by Mobil Oil Francaise, won a medal at the 1958 Cannes "Journees Europeenes du Film Technique et Industriel", while the second, made by Mobil Oil Italiana, won a silver medal at the 2nd National Festival of Industrial Documentary Films at Monza, June 1958.

Lubricants With Care deals with the manufacture, transportation, storage, application, and reclamation of lubricants. It opens by giving an idea of the complexity of their manufacture and the need for strict precautions and frequent inspections. Package preparations and filling are also featured. The film goes on to show how storage should be carried out, why stores accounting should be emphasized, and how correctly designed containers can avoid many common errors during the application of lubricants to all types of machinery. Finally, there is a sequence on reclamation.

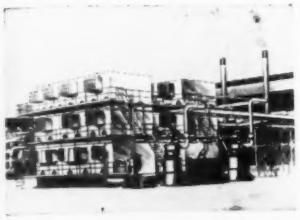
Compressor Lubrication deals with the operating principles and lubrication of all types of compressors. The opening sequences cover the operating principles of reciprocating compressors, especially how this type of machine is constructed and how good lubrication can plan an important rôle in economical operations. Rotary and axial type machines are dealt with in a similar fashion. The film has been designed for all types of audience.

Trade Literature, etc.

World's Largest Sea Water Distillation Plant

G. & J. Weir Ltd, the Glasgow engineers, has received an order worth over £500,000 from the Government of Kuwait for what will be the largest "fresh water from sea water" plant in the world.

The plant, of the Weir *Multiflash* type, consists of two units, each of which will produce one million gallons of fresh water a day —the greatest output ever achieved by a single flash distillation unit.



An impression of the Weir "Multiflash" sea water distillation plant

Qatar Order for Drilling Units

The English Electric Company has received a repeat order for five 8V diesel package units from the Qatar Petroleum Company Ltd, following the successful operation in Qatar of identical units engaged on deep test drilling.

The package units now operating in Qatar supply the power to the drilling rig and to the independently-driven slush pump, and are the dual-fuel type to enable the natural gas available locally to be utilized. This rig is one of the largest in operation in the Middle East and is capable of drilling to depths of 16,500 feet.

Mobile Exhibition of Industrial Valves

The 1959 tour of the mobile exhibition of industrial valves manufactured by Newman, Hender & Co. Ltd, Woodchester, Stroud, Gloucestershire, began in April.

The tour commenced in Portugal where the exhibits are being displayed at the British Trade Fair in Lisbon, on the 29 May to 14 June. Other countries to be visited are Switzerland, Germany, and Austria.

"Triaryl Phosphates"

A fifty-page bulletin on recent developments in the use of triaryl phosphates—functional fluids and additives to lubricating oils, hydraulic fluids, and fuels—has been published by The Geigy Co. Ltd, Rhodes, Middleton, Manchester.

The publication has the threefold purpose of indicating new developments in the use of triaryl phosphates; detailing background literature and theory on these uses; and surveying the literature on the use of the product in applied lubrication.

Steel Foundry Service

In a new 28-page booklet, The North British Steel Foundry Ltd, of Bathgate, Scotland, has given first place to a description of the way in which their foundry is equipped to provide *A Steel Foundry Service*.

Amongst other things discussed in this booklet are the controls over processes, materials, and production that are applied; the machining of steel castings, their conjunction into part-assemblies, and their integration into fabricated assemblies. The factors which influence the design of cast steel parts, and the condition in which these parts shall be supplied, are also discussed.

The booklet is also a valuable source of reference to the use of steel castings and steels generally. In an 11-page reference section, the mechanical properties, chemical test requirements, and equivalent specifications are given for 31 steels, together with short descriptions of their individual properties and applications.

Oil-Resistant Industrial Gloves

A new range of industrial gloves and gauntlets made from *Hycar*, a nitrile rubber highly resistant to oils, is being produced by the Dunlop Rubber Company. These gloves are especially resistant to petroleum products, vegetable and animal fats, oils, alcohols, glycols, and many common solvents.

Enquiries should be addressed to Dunlop Rubber Company Ltd, General Rubber Goods Division, Car-bridge Street, Manchester.

Colour Measurement

A descriptive pamphlet on the redesigned Lovibond Schofield Tintometer for the measurement of the colour of solids, powders, pastes, liquids, and light sources, has been published by The Tintometer Ltd, The Colour Laboratory, Waterloo Road, Salisbury.

The Lovibond system of colour measurement is based on the Lovibond scale of permanent glass colour filters. In the Lovibond Schofield Tintometer, a suitable selection of filters is provided with easy means of manipulation, an optical system, and illumination conforming to the C.I.E. (Commission Internationale de l'Eclairage) requirements. Dull or bright colours, or mono-chromatic greys to black, can all be measured and recorded equally exactly.

The sample is viewed through the eyepiece under correctly standardized conditions, and matched by a suitable combination of any two of the three Lovibond scales. The answer may be left in terms of the Lovibond scale, or quickly converted into the tri-chromatic co-ordinates x, y, z, of the CIE system for either illuminant B or C from the monogram provided.

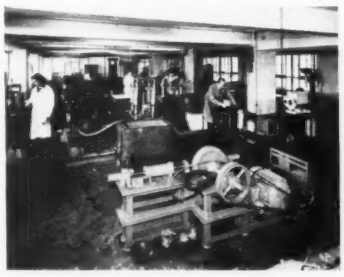
The user thus has the advantages of the very simple, easily understood, and handled Lovibond system, with the mathematical advantages of expression in the CIE system.

New Works for Auto-Klean and Beldams

Formally opened by the Rt Hon Harold Watkinson, MP, Minister of Transport and Civil Aviation, on 27 April, the new additional factory of the Beldam Group—Beldam Asbestos Co. Ltd, Auto-Klean Strainers Ltd, The Submerged Log Co. Ltd—fulfils a need brought about by the continued expansion of the Group's activities. The ceremony also marked the 70th anniversary of the foundation of the firm for, as Robert Beldam, chairman of the Group said, it was in 1889 that his grandfather founded the business.

To-day, Beldam's packings and the strainers and filters manufactured in the Hounslow factory are well-known products, not only in the United Kingdom but in many other countries.

The new building covers a floor area of about 100,000 square feet. It has four floors in front, the rear portion being a well-fitted machine shop, 30 ft. high, with three gantry cranes. An interesting experimental department (pictured on the left) is also available and equipped with various testing machines.



Auto - Klean filters are particularly applicable to oil - firing systems from the largest industrial installations to small domestic appliances. Attractive booklets describing the principles of the different types and outlining the types available are obtainable from the Company on application.

Also on view at the opening ceremony were the Chernikeeff Log and the Bendix depth recorder. Although these are manufactured at Chiswick, the Submerged Log Company's office is in the new Hounslow building.

The heavy machine shop

The "Courlose" Manual

British Celanese Ltd has published a data and applications manual for their product *Courlose* (sodium carboxymethyl cellulose), a water-soluble cellulose derivative, having properties which make it particularly useful for thickening, preventing coagulation, stabilizing dispersions, and for sizing and coatings.

The manual contains details of all the grades in which the product is supplied and outlines their applications in a wide variety of industries. It is not intended that it should replace the booklets dealing with specific industries.

The manual is designed on a loose-leaf system, and from time to time British Celanese Ltd will issue supplementary leaflets describing new grades of *Courlose* as they are developed.

Copies may be obtained from British Celanese Ltd, Chemical Sales Department, Foleshill Road, Coventry, Warwickshire.

Charringtons in the North West

Charrington, Gardner, Locket & Co. Ltd announce the opening of their new North West Oil Sales Division with offices at Fanum House, York Street, Manchester.

Charringtons, already sole distributors of Mobil Fuel Oils over a wide area embracing London, East Anglia, and the Midlands, will now extend their fuel oil marketing activities to cover the North West of England and North Wales.

Supplies of all grades of Mobil Fuel Oils for industry and the home will be distributed in Charringtons' own transport from Mobil Oil Company's new £1 million ocean terminal at Ellesmere Port, now nearing completion.

The divisional sales manager in charge of the new office is A. E. Thomas, M.I.H.V.E., M.R.S.H., until recently manager of Charringtons' Heating Engineering Department in London.

Steel Tube Contract with U.S.S.R.

Stewarts and Lloyds, the steel tube manufacturers, have recently negotiated two contracts with Russia—one for £460,000-worth of boiler and steam tubes, and the other for £383,000-worth of oil-well tubing for the Russian oil industry. Much of the tonnage involved (5500 tons for the first contract and 4100 tons for the second) will be produced at Stewarts and Lloyds' works at Corby.

Together these two contracts constitute by far the largest order received by Stewarts and Lloyds from the U.S.S.R. since before the second world war.

Australian Contract for Power Gas Corporation

The Power-Gas Corporation (Australasia) Pty Ltd, Australian subsidiary of The Power-Gas Corporation Ltd, Stockton-on-Tees, has received an order worth £A 800,000 for one unit of carburetted water gas plant from the Australian Gas Light Company for their Mortlake Works, Sydney.

The unit will have a normal capacity of 9 million cu ft of 550 Btu gas/day, with a peak load capacity of 12 million cu ft/day. It is believed to be the largest single unit of C.W.G. plant ordered in the world.

The unit will incorporate a generator of the dry base type and will utilize the reverse flow carburetting system, for the use of heavy oil. A unique feature of the plant is that, except for certain control equipment, it will not be housed, thus following a similar trend adopted in recent years for catalytic oil gas plants. It is planned for completion by about mid-1960.

Tank Cleaning

A new method of chemical-physical tank cleaning for the removal of oil and asphalt residue, has been announced by the International Groom Company GmbH, Hamburg 11, Vorsetzen 39. Called the *Groom* system, the cleaning detergent is not expended, but is recovered during the process and used again in a closed circuit. The detergent is claimed to be effective against nearly all existing oils and greases—mineral, animal, and vegetable. A descriptive folder is available from the Company.

Holmes-Western Gas Valves

A well-produced brochure, illustrated in colour, describes in comprehensive fashion the Holmes-Western "55" gas valves. It deals with not only the five main groups which comprise the "55" range, but also with earlier types of Western valves. Full tabular details are given regarding standard dimensions of valves and pipe flanges. Copies of the brochure can be obtained from the Advertising Department, W. C. Holmes & Co. Ltd, P.O. Box B7, Turnbridge, Huddersfield.

New Lever-Lift Drilling Mast

Under the auspices of the Oil Well Supply Co. Ltd, a party of selected members of the technical press recently witnessed the trial rig-up of an *Oilwell* No. 66 drilling rig at the Gateshead-upon-Tyne works of Armstrong Whitworth (Metal Industries) Ltd, and Wright Anderson Ltd.

The works of the former company is where *Oilwell-Britain* drilling machinery is manufactured, whilst the latter were the fabricators of the new *Oilwell-Britain* 128-ft lever-lift mast.

This rig was the first of sixteen such being manufactured in Britain for shipment to Yacimentos Petroliferos Fiscales, Argentina. Although the design had been fully field proven, this was the first 128-ft mast to have been built and raised anywhere in the world.

The draw-works are rated for drilling to 6000–8000 ft, whilst the lever-lift mast is the smaller version of the 136-ft variety first built at the Oil Well Supply Company plant in Texas, in 1958. The whole structure of mast and substructure contains not one loose nut and bolt for use in rigging up.

Du Pont Synthetic Rubber Research Centre

A new modern laboratory devoted to development work on neoprene and other synthetic rubbers and rubber chemicals for the European rubber industry was opened early in May by the Du Pont Company (United Kingdom) Ltd at Hemel Hempstead.

The laboratory, officially designated the Elastomers Research Laboratory, is the first permanent facility to be completed by Du Pont in Europe. It will be staffed entirely by British graduates and technicians. Wilfred P. Fletcher, an authority in the European rubber industry, is manager.

Hygiene Everywhere

Hygiene in the factory, in the canteen, in the washrooms, in fact everywhere, is of the utmost importance. A clean towel for every wash and one which is so cheap that it can immediately be thrown away is the ideal and can be provided by the use of *Hi-Dri* paper towels. At a recent demonstration in London, the manufacturers introduced a new *Hi-Dri Super* towel with a very fast absorbency rate and the same high wet strength of its predecessor. On test an absorbency rate of less than two seconds was attained and a collection of Wedgewood china weighing 4 lb was supported in a piece of towelling immersed in water several times.

Hi-Dri paper also has many other uses. For example, the removal of oil from machinery, the cleaning of crockery, the washing of floors, and so on. It is available in roll form, 9 or 18 inches wide and 250 feet in length, and as individual folded towels. Details are obtainable from Sales Manager, Kimberley-Clark Ltd, Larkfield, nr Maidstone, Kent.

Short & Mason Manchester Office

Short & Mason Ltd, has announced that William K. Gregson has joined the Company as the Northern Area representative, and may be reached at 32 Park Road, Sale, Cheshire.

★ ★ ★

SITUATIONS VACANT

GREASE CHEMIST

required by major Company for work in the West London area. Candidates should be qualified chemists, specializing in grease development and testing. Previous experience of grease work is essential.

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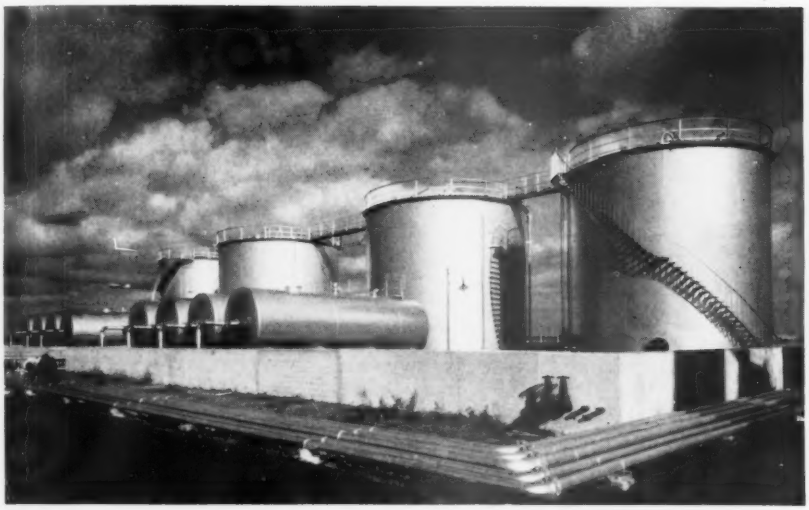

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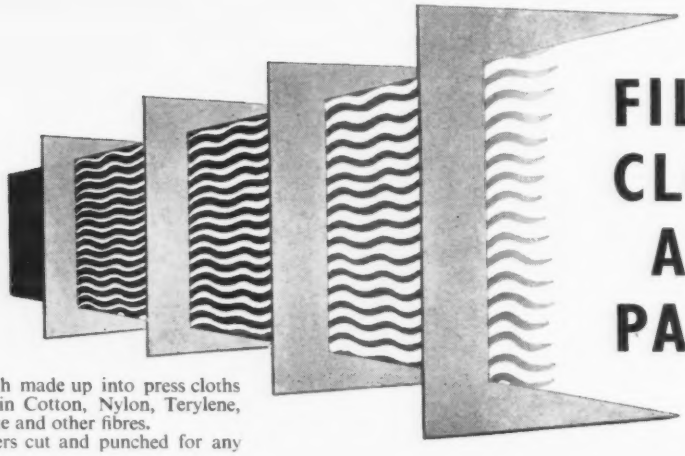

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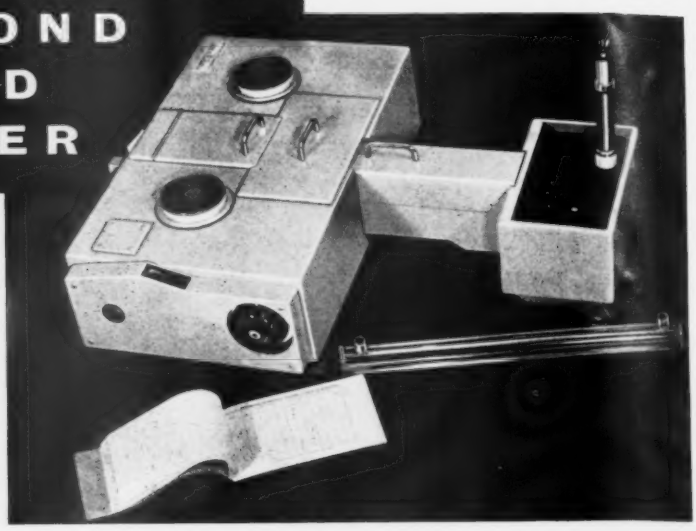

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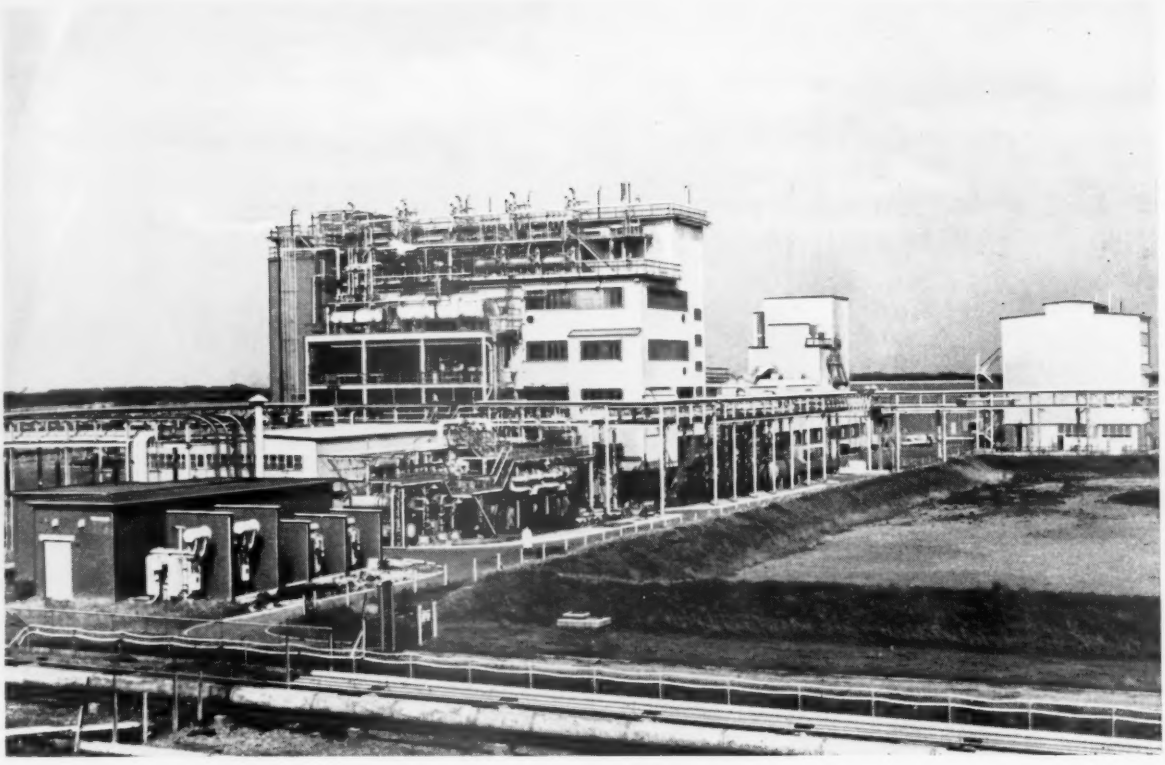

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